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PUPAE OF SOME MAINE SPECIES OF NOTODONTOIDEA.

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BULLETIN 259

PUPAE OF SOME MAINE SPECIES OF NOTODONTOIDEA.*

EDNA MOSHER.†

INTRODUCTION.

It is only in recent years that entomologists have realized the value of studying the immature stages of insects, although immature forms are responsible for more damage to crops than adults. Now that the need for such studies is felt, it is surprising how very little we really know about the subject. The pupae have rarely been considered even from the standpoint of the systematist, much less from that of the economic entomologist. Nevertheless it is important to be able to recognize an insect pest at any stage of its life-cycle, even if it does no damage while in that stage.

These studies of the pupae of some of the commoner forms found in Maine will, it is hoped, lead to the easy recognition of the species described, and awaken an interest in this stage of the insect's life history.

The pupae were, for the most part, obtained by collecting the eggs or larvae and rearing them to maturity in order to identify the species, as will be necessary until the larval and pupal stages are more carefully studied. This work was done during the summer of 1915, but the season was not a favorable one for rearing Lepidoptera, being very cold and wet. Many of the specimens died of fungous or bacterial diseases, the Geometridae being especially hard to rear successfully. In some

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The synonymy used is, for the most part, that of Dyar's check list.

cases the life history has been supplemented by material from the author's private collection. The adults were identified partly by Dr. T. H. McDunnough of Decatur, Illinois, and partly by the author, while Dr. W. T. M. Forbes identified larvae of several species.

MORPHOLOGY.

The pupae described here belong to the type known as obtected pupae because all of the appendages are firmly soldered to the body wall and have no power of independent movement. In order to understand the following descriptions, the terms used will be briefly described.

A hypothetical pupa is shown in Fig. 2, A and B to which reference will be made under the discussion of the different structures.

THE HEAD

Vertex. The vertex is found on the dorsal surface of the head. In the pupae described here, it is confined to a small, triangular area adjacent to each antenna (Fig. 2, B, v). The vertex is bounded cephalad by the epicranial suture (Fig. 2, B, es), but only a portion of each of the epicranial arms is visible.

Front. The front (Fig. 2, A, f) is the sclerite to which the antennae are attached. It is separated from the vertex, when this is present, by the epicranial suture. The fronto-clypeal suture is not present, but the front includes most of the ventral surface of the head.

Clypeus. This sclerite (Fig. 2, A, cl) cannot be definitely bounded in specialized pupae. The invaginations for the anterior arms of the tentorium (Fig. 2, A, at) which are always distinct, are located along its lateral margin.

Labrum. The labrum (Fig. 2, A, lb) is caudad of the clypeus and is not separated from the clypeus by a suture. Its other margins are always distinct.

Eye-pieces. These are situated mesad of the antennae and each is composed of two parts, a narrow smooth portion along the mesal margin called the glazed eye-piece (Fig. 2, A, ge) and a broader lateral portion called the sculptured eye-piece (Fig. 2, A, se). These are often hard to distinguish in smooth pupae.

Antennae. These are easily located (Fig. 2, A, a) being attached to the front and curving laterad along the margin of the head, extending on to the ventral surface of the thorax and abdomen along the edge of the mesothoracic wing.

Labial Palpi. Only a very small portion of the labial palpi is visible just caudad of the labrum (Fig. 2, A, lp).

Maxillae. The maxillae (Fig. 2, A, mx) lie adjacent on the meson and vary greatly in length. They are measured on the meson from the caudal margin of the labrum to their distal end, (Fig. 2, A, a). This length is compared with the distance on the meson from the caudal margin of the labrum to the caudal margin of the wings (Fig. 2, A, ac).

The parts of the head, exclusive of the appendages, are referred to as the face-parts.

THE THORAX.

Prothorax. This segment (Fig. 2, B, p) is normally about one-third the length of the mesothorax.

Prothoracic Legs. These lie adjacent to the maxillae (Fig. 2, A, l1). The legs are folded so that normally only the surface of the tibia and tarsus are exposed. In generalized forms, however, a portion of the femur is visible (Fig. 2, A, f1). These legs are about half the length of the wings in the great majority of pupae.

Mesothorax. The mesothorax (Fig. 2, B, ms) is the longest segment of the body, and is normally from two to three times the average length of the abdominal segments.

Mesothoracic Spiracle. The opening to this spiracle referred to in the text as the mesothoracic spiracle (Fig. 2, B, msp), is found at the cephalo-lateral angle of the mesothorax, between that segment and the prothorax. The real spiracle is down below the surface in the conjunctiva between the two segments.

Mesothoracic Legs. These are folded just like the prothoracic legs and lie adjacent to them, but their femora are never exposed (Fig. 2, A, l2). The part referred to as mesothoracic leg is in reality the outer surface of the tibia and tarsus. These legs are from three-fifths to three-fourths the length of the wings in the majority of pupae.

Mesothoracic Wings. The wings of the mesothorax (Fig. 2, A, wl) almost conceal those of the metathorax and are visible on both dorsal and ventral surfaces. In most pupae they are the only wings visible on the ventral surface.

Metathorax. This segment (Fig. 2, B, mt) is usually about as long as the first abdominal segment.

Metathoracic Legs. These legs (Fig. 2, A, 13) are never visible for their entire length, and are sometimes entirely concealed. The tips are often visible on either side of the meson near the caudal margin of the wings.

Metathoracic Wings. These are usually concealed by the mesothoracic wings except for a narrow strip along the dorsal margin (Fig. 2, A, w2). In Platypterygidae they are visible on the ventral surface.

ABDOMEN.

The abdomen consists of ten segments (Fig. 2, B, a1 to a10). The first three segments are only visible in dorsal view. The fourth usually shows a slight margin below the wings on the ventral surface and all of the other segments are visible on both surfaces. There is movement possible between the fourth and fifth, fifth and sixth, and sixth and seventh segments, and the fourth, fifth and sixth are said to be movable segments. The pupa is thus capable of expanding and contracting the body and can bend it from side to side. The movements possible between these segments enables the pupa to work its way out of the ground, or out of a cocoon. These movable segments generally fit over one another so that the transverse conjunctiva of one covers the cephalic portion of the next segment. This cephalic portion is referred to as the cephalic margin (Fig. 2, B, cm). The transverse conjunctiva differs from the remainder of the segment in texture and is usually lighter in color. Its cephalic boundary is indicated in the figures by a dotted line.

Tubercle Scars. The larvae often bear prominent tubercles or projections on the body and the scars (Fig. 2, B, ts) of these are nearly always visible on the body of the pupa.

Anal Opening. This is situated on the meson near the caudal margin of the tenth segment (Fig. 2, A, ao). It is usually slit-like and surrounded by prominent wrinkles or folds.

Genital Openings. The sexes may be easily distinguished by the position of the genital opening (Fig. 2, A, go). That of the male is situated on the meson of the ninth segment. That of the female is situated mostly on the eighth segment or on both eighth and ninth segments. The cephalic margins of segments eight and nine curve strongly cephalad in the female, and this alone is sufficient to indicate the sex. In generalized pupae there are two unpaired genital openings in the female, a condition retained by many of the specialized forms.

Abdominal Spiracles. These (Fig. 2, B, s) are present on the first eight segments but are never visible on the first segment, being entirely covered by the wings. The spiracle on the eighth segment is never functional and shows no distinct opening.

Spiracular Furrows. These are found on the cephalic margin of some or all of the movable segments just cephalad of the spiracles (Fig. 2, B, sf). In many genera they are only present on the fifth segment. In some genera there are a number of low ridges, in others a very distinct pocket-like invagination.

Cremaster. The cremaster (Fig. 2, B, cr) is a prolongation of the tenth segment. It is of various shapes and lengths and often separated from the tenth segment by a depression. Its length is measured on the ventral surface, from its junction with the curve of the tenth segment to the distal end. In Fig. 2, A, ab represents the cremastral length.

CLASSIFICATION.

The superfamily Notodontoidea, as considered in this paper, includes the families Geometridae, Notodontidae and Platypterygidae. The family Dioptidae also belongs to this superfamily but there are no species in the eastern states.

The pupae of this superfamily are not always easy to separate from those most closely related, the Noctuoidea and Bombycoidea. As in the case of the larvae and adults, there is no one prominent character by which they may be recognized, and it is only a careful comparison of several characters that enables us to recognize the pupae of the Notodontoidea. The labial palpi are seldom exposed, and then only a small triangular or polygonal portion caudad of the labrum, thus differing

from the great majority of the families Noctuidae, Liparidae, and Lasiocampidae in which they are often visible for one-fifth the length of the wings. There are no prominent setae on the body, which separates them from most of the Arctiidae, Liparidae, Lasiocampidae, and some Noctuidae. As a general rule only the prothoracic leg extends cephalad between the sculptured eye-piece and the antenna. Nearly all of the Noctuidae which do not show a large portion of the labial palpi and prothoracic femora, have both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-piece and the antenna.

Briefly summarized the characters of the superfamily Notodontoidea are as follows: Epicranial suture very seldom visible; antennae separated from the face-parts by a distinct suture, always broadest at the proximal end, the greatest width about equal to that of the prothoracic legs, but never much broader; labial palpi seldom visible, and then only a small triangular or polygonal portion caudad of the labrum; prothoracic femora only exposed in the generalized families of Geometridae; mesothoracic leg very seldom extending cephalad between the sculptured eye-piece and the antenna; body surface never densely covered with setae or having prominent setae arranged in rings or around prominent oval areas; abdominal segments usually punctate; cremaster usually present, and setae at the distal end always hooked.

The dorsal surface of the abdomen frequently shows a deep furrow between the eighth and ninth abdominal segments. The caudal margin of this furrow is usually serrate or crenulate. There are also spiracular furrows found in many species. These vary in number and form, and are mostly found in the Geometridae. The families of Notodontoidea may be separated as follows:

a. Metathoracic wings never visible on the ventral surface of the body.

b. Maxillae usually more than three-fifths the length of the wings, if not, then the caudal end of the body with hooked setae, or the spiracles of the third abdominal segment concealed by the wings and those of the sixth segment farther ventrad than those of the other segments; prothoracic femora sometimes exposed; a deep

furrow usually present on the dorsum of the abdomen between the ninth and tenth segments; caudal margin of mesonotum never with a row of deep pits with smooth tubercle-like areas between. *Geometridae.*

bb. Maxillae seldom exceeding three-fifths the length of the wings, if so, then the caudal margin of the mesothorax with a row of deep pits with smooth, elevated, quadrangular, tubercle-like areas between them, or with the entire body surface coarsely punctate; abdominal spiracles of the third segment never concealed by the wings, and those of the sixth never farther ventrad than the remainder; prothoracic femora never exposed; a furrow never present on the dorsum of the abdomen between the ninth and tenth segments except in Datana where the cremaster is of the type shown in Fig. 5, E to H. *Notodontidae*

aa. Metathoracic wings meeting on the meson caudad of the mesothoracic legs, and visible along the caudal margin of the mesothoracic wings. *Platypterygidae.*

Family GEOMETRIDAE.

The pupae of this family are, with a few exceptions, less than an inch in length. The majority of species are about half an inch long. They are either found suspended from leaves with the cremaster fastened in a mat of silk, much as the chrysalids of butterflies, or they may be found in thin cocoons attached to a leaf, or in a cell in the ground. The legs are longer than is usual in lepidopterous pupae, the prothoracic legs usually three-fourths the length of the wings; the mesothoracic legs normally reaching the caudal margin of the wings, or only separated by a very short distance. This is the best single character to separate the pupae of Geometridae from those of the other families. The epicranial suture is present in a very few genera. The labial palpi are sometimes exposed as small triangular or polygonal areas caudad of the labrum. The prothoracic leg and occasionally the mesothoracic also, extends cephalad between the sculptured eye-piece and the antenna. The femur of the prothoracic leg is sometimes exposed, often only a very narrow portion, which might easily be overlooked. The

maxillae are always long, nearly always extending to the caudal margin of the wings. The antennae vary little throughout the family. They are usually about as wide as the prothoracic legs, measuring the proximal part of both, and are gradually narrowed to the distal end, which usually extends to the caudal margin of the wings. The metathoracic wings usually extend along the margin of the mesothoracic wings on the dorsal surface, but are not visible in ventral view. The mesothorax is very short in some genera and the entire thorax sometimes very short in relation to the remainder of the body. The mesothoracic spiracles often have a decided projection adjacent to their caudal margin. This may be a sharp ridge, or it may be a prominent tubercle which is often flattened and bears numerous short setae. The abdominal spiracles are sometimes produced and very often the spiracles on the sixth segment are considerably ventrad of the others. Spiracular furrows are frequently present, varying greatly in size and number. The dorsal furrow between the ninth and tenth abdominal segments is present in many genera. It often bends caudad near the lateral margin of the body and this lateral extension may reach to the base of the cremaster. A cremaster of some type is always present. In the pupae examined during this investigation only two types were found, the triangular type with hooked setae, and the bifurcate type, with or without hooked setae.

The coloring of the pupa varies considerably in this family. While the majority are chestnut or darker brown, in common with most lepidopterous pupae, there are some which are nearly white, others yellowish, and various shades of yellowish and reddish brown. Some are conspicuously marked with black or dark brown and one of the pupae described has a beautiful pearly luster. The genera described here may be separated as follows:

a. Cremaster with prominent hooked setae at the distal end, but never bifurcate.

b. Cephalic end of body very blunt and each cephalo-lateral angle prominently produced; a large portion of the prothoracic femur exposed. *Cosymbia.*

bb. Cephalic end of body rounded; the prothoracic femur never visible, or only a very narrow portion of it exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments; antennae usually reaching the cephalic margin of the fifth abdominal segment. *Aplodes.*

cc. Dorsal furrow always present between the ninth and tenth abdominal segments; antennae seldom extending beyond the caudal margin of the wings.

d. Caudal margin of the dorsal furrow between the ninth and tenth abdominal segments with very small, inconspicuous projections; the two lateral setae adjacent to the mesal setae or spines on the cremaster larger than the others. *Ania.*

dd. Caudal margin of the dorsal furrow between the ninth and tenth abdominal segments with prominent projections; lateral setae of the cremaster all of the same size.

e. Abdomen never densely punctate, either smooth or with shallow impressed lines; color never brown.

f. Body white, conspicuously marked with black, never iridescent. *Cingilia.*

ff. Body pale yellow or green, always iridescent. *Sicya.*

ee. Abdomen densely punctate; color always brown.

f. A small portion of the prothoracic femur exposed; head never showing three small tubercles at the cephalic end. *Sabulodes.*

ff. Prothoracic femur never exposed; head always showing three small tubercles at the cephalic end. *Abbotana.*

aa. Cremaster always bifurcate at the distal end, often with hooked setae, but these weak and easily broken.

b. Prothoracic femur exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments, nor a prominent dorsal furrow on the fifth abdominal segment.

d. Cephalic margin of fifth abdominal segment with a furrow over each spiracle; mesothoracic spiracle never with a prominent ridge adjacent to its caudal margin. *Cleora.*

dd. Cephalic margin of fifth abdominal segment with four or five shallow furrows over each spiracle; mesothoracic spiracle always with a prominent elevation adjacent to its caudal margin. *Diastictis.*

cc. Dorsal furrow present between the ninth and tenth abdominal segments, and a very prominent one on the dorsum of the fifth abdominal segment. *Hydria.*

bb. Prothoracic femur never exposed.

c. Dorsal furrow never present between the ninth and tenth abdominal segments; a prominent tubercle never present adjacent to each mesothoracic spiracle. *Paleacrita.*

cc. Dorsal furrow always present between the ninth and tenth abdominal segments; a prominent tubercle adjacent to each mesothoracic spiracle. *Erannis.*

Genus COSYMBIA Hübner.

Body much wider at the cephalic end and truncate, the cephalo-lateral angles distinctly produced; face-parts considerably elevated, a transverse ridge extending across the front on a line with the cephalic angle of the eye-pieces; labrum quadrate in outline; labial palpi not visible; maxillae reaching nearly to the caudal margin of the wings, the proximo-lateral angles not quite reaching the eye-pieces; prothoracic legs almost three-fourths the length of the wings, their femora exposed; the legs reaching cephalad between the sculptured eye-pieces and the antennae; mesothoracic legs reaching the caudal margin of the wings, always longer than the maxillae; tips of the metathoracic legs showing caudad of the maxillae; prothorax on the blunt cephalic end of the body, scarcely visible in ventral view, its mesal length one-third that of the mesothorax; mesothoracic spiracle with a large rounded tubercle adjacent to its caudal margin which form the produced cephalo-lateral angles of the body as seen in either dorsal or ventral view; mesothorax with a distinct lateral ridge which extends from the base of the spiracular tubercle caudad to near the anal angle of the wing; mesal length of metathorax one-fourth that of the mesothorax, the caudal margin curved slightly at the meson; abdominal segments smooth, never punctate; abdominal spiracles small, el-

liptical, those of the second segment covered by the wings; no spiracular furrows present; no dorsal furrow present between the ninth and tenth abdominal segments but a very distinct constriction or furrow at the base of the cremaster; cremaster triangular, longer than broad, the distal end with six strong hooked setae and two finer hooked setae just cephalad of these.

COSYMBIA LUMENARIA Hübner.

Fig. 2, C.

Color usually bright green with three interrupted, longitudinal white stripes on the dorsum, one of these on the meson and one on either side, a broader, less interrupted white stripe through the spiracles, the body more or less mottled between the stripes with either small black or white blotches; lateral ridge usually with a narrow white stripe on the dorsal side and a broader black stripe on the ventral; body often entirely white with the black stripe near the lateral ridge; head, thorax, and appendages smooth, or with very fine transverse striations, antennae at proximal end equal to greatest width of the prothoracic legs, but narrowing rapidly so that they are only one-third as wide at the distal end; abdomen smooth, the segments tapering gradually to the caudal end of the body.

Length 10 to 11 mm.; greatest width 2.5 to 3 mm.

The larvae were very abundant on sweet fern and were often found feeding along the edge of the leaf. Some of the larvae were about an inch long, pale green, with white dorsal stripes much as described for the pupae, with fine powdery white dots between, others were brown with indistinct white stripes and darker brown oblique lines or blotches, and seemed to be entirely different, while the pupae and the adults would be exactly alike, or at least appeared to be. Larvae were abundant all through July, and many pupae were collected the latter part of the month and in August. The larvae spin a little knot of silk and fasten themselves to it and then transform to pupae. They are suspended like many butterflies with the hooks of the cremaster fastened into the web of silk and a fine white silken thread around the middle of the body. There is never any trace of a cocoon. The moths emerged in August and many were seen flying about, but the egg-laying habits were not observed.

Genus APLODES Guenée.

Body of usual shape, blunt at the cephalic end, entire body surface roughened with deep, indeterminate, impressed lines; a small portion of the labial palpi exposed caudad of the labrum; antennae extending beyond the caudal margin of the wings, reaching the caudal margin of the transverse conjunctiva when the body is expanded, each distal end curved slightly towards the meson; maxillae never quite reaching the caudal margin of the wings, the tips of the metathoracic legs exposed just caudad of them and between the distal ends of the antennae; proximo-lateral angles of the maxillae not extending to the eye-pieces; prothoracic leg extending cephalad between the sculptured eye-piece and the antenna, about three-fourths the length of the wings, the femur never exposed; mesothoracic legs reaching the caudal margin of the wings and slightly longer than the maxillae; mesal length of prothorax two-thirds that of the mesothorax; opening of the mesothoracic spiracle on a slightly elevated tubercle; mesal length of the metathorax one-fourth that of the mesothorax; metathoracic wings showing a large triangular piece adjacent to the second and third abdominal segments and almost forming a right angle opposite the third abdominal segment; abdominal spiracles almost circular in outline; a dorsal furrow never present between the ninth and tenth abdominal segments; sutures between all of the abdominal segments very distinct; cremaster broadly triangular, continuing the outline of the body except for a slight constriction at its proximal end, armed with eight hooked setae, of which the two mesal ones are slightly longer.

APLODES MIMOSARIA Guenée

Fig. 3, E.

Body variously colored, usually grayish green, sometimes yellowish brown, often tinged with reddish or orange shades, always with a darker dorso-mesal stripe, and dotted with black or dark brown, the bases of the setae conspicuously dark brown or black; cephalic end of body showing a small tubercle on the meson just caudad of the proximal ends of the antennae; proximal ends of the antennae slightly elevated and somewhat tuber-

culate, especially along the middle line; wings slightly elevated along the dorso-lateral margin; abdominal spiracles almost circular in outline, usually slightly elevated, the spiracle of the sixth abdominal segment considerably ventrad of the others; abdominal segments roughened with indeterminate transverse impressions and sparsely punctate; cremaster less than 1 mm. in length, the two caudal setae of each side curved cephalad, the remainder curved caudad.

Average length 12 mm.; greatest width 3 mm.

The larvae of this species were very abundant on sweet fern. They differ from the majority of geometrid larvae in having the lateral margins of most of the abdominal segments produced into triangular projections one on each side of a segment, which makes the lateral margin of the body very strongly toothed. These projections often curve slightly dorsad. The larvae were about an inch long and variously colored. Some were all green, others were tinted with yellowish and reddish colors like autumn leaves, while others were pale yellow tinged with red. The pupae were less variable in color, and no difference could be detected in the adults. The larvae were very difficult to locate as they fed along the edge of the sweet fern leaves, and the notches on their body corresponded in a general way to the notches in the leaves. Many of them were taken by sweeping. The first larvae were collected July 23 and they were abundant till the middle of August. By the third week in August practically all had pupated. The larvae spin a few threads of silk between two leaves and the pupa is held in place in the entanglement of the silk by the hooks on the cremaster.

Genus ANIA Stephens.

Body widest near the cephalic end; surface roughened with deep indeterminate impressed lines on head, thorax and appendages, densely punctate on the abdomen, never presenting a polished appearance; face-parts elevated, the head with a rounded, transverse ridge just caudad of the proximal ends of the antennae; a small portion of the labial palpi exposed caudad of the labrum; maxillae about seven-eighths the length of the wings, the proximo-lateral angles never reaching to the eye-pieces; prothoracic legs about three-fourths the length of the wings, their femora never exposed; mesothoracic legs longer than

the maxillae and meeting on the meson caudad of them, often separating to show a small portion of the tips of the metathoracic legs; both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-pieces and the antennae; antennae reaching to the caudal margin of the wings and meeting on the meson; prothorax about half the length of the mesothorax; mesothoracic spiracles with the caudal margin elevated and somewhat flaring; abdominal segments 1 to 8 densely punctate; abdominal spiracles elliptical, slightly produced; spiracular furrows present on segments 5 to 7, the surface of the furrows punctate like the remainder of the segment; furrow present on the dorsum between the ninth and tenth abdominal segments, the edges very finely serrate; cremaster triangular in outline, rugose, with two large long hooked spines at the distal end, at the base of these two stout hooked setae, and cephalad of these two hooked setae near each lateral margin, forming a transverse row.

This genus consists of a single species in North America.

ANIA LIMBATA Haworth.

The Horned Span-worm. Fig. 2, E and H.

General color light brown, with darker brown markings, most of these small, irregular spots; antennae with dark brown inverted V-shaped markings; ventral surface of abdomen showing three broad stripes, the mesal one more distinct than those near the lateral margin; dorsal surface of abdomen with broad, indistinct, oblique bands of a lighter color; bases of the setae dark brown, and usually the distal portion of the cremaster; antennae slightly elevated, with a row of minute tubercles along the middle line; abdominal segments 1 to 8 finely, densely punctate, the ninth and tenth segments smooth; segments two and three with a more or less distinct tubercle on each side the meson indicating the scars of the larval filaments; segments five, six and seven with a distinct elevation along the cephalic margin; dorsal furrow between segments nine and ten with a lateral extension, the caudal margin (Fig. 2, H) notched on the meson and slightly serrate; cremaster 1 mm. long, slightly rugose, and showing a slight constriction on each lateral margin at the base.

Average length 9 mm.; greatest breadth 3 mm.

The larvae of this species are easily recognized by the group of four filaments that stand up on the back with their ends slightly curled. The first pair is attached to the second abdominal segment. They feed on various plants and were collected at Orono on sweet fern during the first week in August. The larvae pupated the fifth of August between the leaves of sweet fern, but did not form a cocoon.

Genus CINGILIA Walker.

Body slender, but of usual type; labrum quadrangular; a small polygonal portion of labial palpi exposed caudad of the labrum; antennae extending to the caudal margin of the wings, their greatest width greater than that of the prothoracic legs, their distal ends usually meeting on the meson; maxillae almost reaching the caudal margin of the wings, the proximo-lateral angles not extending laterad to the eye-pieces; prothoracic legs three-fourths the length of the wings, their femora never exposed; mesothoracic legs seven-eighths the length of the wings; only the prothoracic leg extending cephalad between the sculptured eye-piece and the antenna; mesal length of prothorax two-fifths that of the mesothorax; metathorax about half the length of the prothorax and slightly shorter than the first abdominal segment; abdominal segments with shallow, transverse impressed lines; dorsal furrow between the ninth and tenth abdominal segments present, the caudal margin crenulate; cremaster without a furrow at the base, ending in two long hooked spines with one short hooked seta on each side, a transverse row of four similar setae just cephalad of these.

This genus includes a single species in America.

CINGILIA CATENARIA Drury.

The Chain-dotted Geometer. Fig. 4, C and F.

Color white with conspicuous black blotches, the largest of these on the dorsum of the first five abdominal segments, the wing veins and some of the sutures lined with black; entire surface of body with shallow transverse impressed lines; antennae elevated, highest along the middle line, transversely lined with black; mesothoracic spiracles split-like; abdominal spira-

cles without any outer margin, the openings elliptical; cremaster (Fig. 4, F) with two large spines and six smaller ones.

Length 15 to 18 mm.; greatest width 3.5 to 4 mm.

The larvae of this species are pale yellow with some narrow dark brown or black stripes and marked with conspicuous black spots near the spiracles and on the lower part of the body. They feed on numerous plants, and specimens were collected from larch and sweet fern August 8. They pupated shortly after, spinning a very loose open cocoon through which the pupa could be easily seen. The cocoon was attached either to a leaf or a stem. The adults are white, and also conspicuously marked with black. They emerge in September.

Genus SICYA Guenée.

Body of usual type; surface smooth with a few punctures on the abdomen; labial palpi represented by a small triangular area caudad of the labrum; maxillae seven eighths the length of the wings, the proximo-lateral angles scarcely reaching to the eye-pieces; antennae elevated, extending to the caudal margin of the wings, their greatest width slightly greater than that of the prothoracic legs, and meeting or approaching each other on the meson; prothoracic legs about two-thirds the length of the wings, extending cephalad between the sculptured eye-pieces and the antennae, mesothoracic legs nearly as long as the wings, meeting on the meson just caudad of the maxillae; mesal length of prothorax about half that of the mesothorax, while the metathorax is one-fifth of this length; mesothoracic spiracle slit-like, the cephalic margin slightly elevated; spiracular furrows not present; dorsal furrow present between the ninth and tenth abdominal segments, the caudal margin showing two large projections; cremaster triangular, longer than the tenth segment, two large hooked spines or setae at the end, with three smaller, but heavy hooked setae on each side just cephalad of the others.

SICYA MACULARIA Haworth.

Fig. 2, D and G.

Color pale yellow and green with silvery and pale green iridescence; surface smooth and polished, the setae rather con-

spicuous under the microscope and arising from small brown tubercles; median line of thorax brown, also a line indicating the suture at the base of each antenna, the spiracles, the glazed eye-piece, the margin of the prothorax, and the cremastral hooks; abdominal segments 1 to 7 with a few, very fine punctures which are scarcely apparent, segments 3 and 4 have a row of larger punctures along the cephalic margin of the segment, while segments 5 to 7 have a few larger ones scattered over the surface of the cephalic margin; abdominal spiracles almost circular, produced, the openings ovate in outline; cremaster (Fig. 2. G) with a distinct furrow at base, the dorsal surface depressed below the level of the tenth segment, and rugose with fine longitudinal striations; cremaster 1 mm. in length, the lateral hooks flattened and broader at the end.

Length 12 mm.; greatest width 4 mm.

The larva of this species was ready to pupate when collected, and therefore no description was obtained. It was collected July 2 on wild white spiraea. The larva first spun a very open web of silk which bent over the tip of the leaf and fastened it down. This web was drawn around the larva to form a sort of cocoon. The pupa at first was pale green with a brown median line on the thorax and brown around the spiracles. The dorsum of the body was lighter in color than the remainder, and had the appearance of being powdered. The body showed a beautiful iridescence even then, but in three days more it was fully hardened, a sort of yellowish-green in color and iridescent over the entire surface. The adult emerged July 16.

Genus SABULODES Guenée.

Body of usual type; surface always dull in appearance, considerably roughened with deep indeterminate transverse, impressed lines on head, thorax, and appendages, the abdomen densely punctate; labial palpi represented by a small polygonal area caudad of the labrum; proximo-lateral angles of maxillae never reaching the eye pieces; maxillae, antennae and mesothoracic legs normally reaching the caudal margin of the wings, sometimes falling a little short of it; prothoracic leg about two-thirds the length of the wings, a very narrow portion of the femur exposed; the prothoracic legs extending cephalad between the sculptured eye-pieces and the antennae; the mesothoracic

leg scarcely reaching the level of the glazed eye-piece in some species and extending farther cephalad in others; mesal length of prothorax one-half that of the mesothorax; metathorax one-fifth the length of the mesothorax and shorter than the first abdominal segment; mesothoracic spiracle slit-like; abdominal segments 1 to 8 punctate; furrow present on the dorsum between the ninth and tenth abdominal segments, the caudal margin coarsely toothed, the lateral extensions reaching almost to the base of the cremaster; cremaster longer than the tenth segment, bearing two stout curved spines at the distal end, with slender hooked setae along each lateral margin, the ventral surface with two deep parallel furrows, one near each lateral margin.

The species of Sabulodes may be separated as follows:

a. Face-parts with a prominent transverse ridge between the eye-pieces; body setae arising from small papillae; caudal margin of furrow between the ninth and tenth abdominal segments with small projections or teeth. *transversata.*

aa. Face-parts never with a prominent transverse ridge between the eye-pieces; body setae arising from small depressions; caudal margin of the furrow between the ninth and tenth abdominal segments with large projections. *lorata.*

SABULODES LORATA Grote.

Fig. 4, B and E.

Color yellowish brown, the spiracles, tenth segment, and cremaster always darker brown, an irregular dark spot on each side the dorso meson of the first eight abdominal segments and one on the mesothorax at about the middle of its length, also fine irregular blotches on other parts of the body which are exceedingly variable; antennae more elevated than the other appendages, highest along the middle line, the surface covered with small tubercles; abdominal segments 1 to 8 densely punctate with medium punctures, the ninth and tenth segments smooth; body setae arising from small pits; abdominal spiracles with the openings elliptical; spiracular furrows never present; dorsal furrow between the ninth and tenth segments edged with black or very dark brown, with four prominent teeth on each side

the meson; cremaster (Fig. 4, E) 1.5 mm. in length, the dorsal surface with deep longitudinal furrows and a transverse furrow at the base, a hooked seta laterad at the base of each large curved spine and a transverse row of four hooked setae of the same size at about one-third the length of the cremaster from the distal end.

Average length 18 mm.; greatest width 4.5 mm.

The larvae of this species are slim brown loopers with three rather prominent tubercles and a ridge on the dorsum of the body. They were only taken from sweet fern. When full grown they attach themselves to the leaves with a few threads of silk and usually pull another leaf over it, so that the pupa is entirely concealed.

SABULODES TRANSVERSATA Drury.

The Large Maple Span-worm. Fig. 4, K.

Color usually yellowish brown, the head, thorax, and appendages of many individuals a much darker brown; the cremaster usually dark brown; surface of body roughened with impressed lines and striations and somewhat tuberculate, there being small distinct, whitish tubercles visible on the appendages and on the eye-pieces; face-parts with a distinct, high, rounded transverse ridge extending from just cephalad of the middle of each glazed eye-piece; antennae tuberculate, the proximal fifth elevated along the middle line and forming a ridge; setae of thorax and abdomen arising from small, dark brown papillae; abdominal segments with the punctures mostly obscured by the ridges, except on the seventh and eighth segments, the ninth and tenth segments smooth; abdominal spiracles usually edged with darker brown, those of the second, third and fourth segments touching the wings, the lips of the openings slightly produced and somewhat crescent-shaped; spiracular furrows indicated on the fifth segment; dorsal furrow between the ninth and tenth abdominal segments distinct, the caudal margin edged with black and finely toothed; cremaster with four longitudinal ridges and a transverse furrow at base, four of the hooked setae inserted on the dorsal surface, and two on the lateral margin.

Average length 17 mm.; greatest width 5 mm.

The larvae of this species were collected from maple, but they are found on other kinds of trees. They are two inches or more in length, dark grayish brown and the mesothorax somewhat swollen at the sides. They pupate by attaching themselves to the leaves with a few threads of silk and then folding the leaf over, or attaching another leaf to it with the silk. These threads of silk do not form a cocoon. The pupa fastens itself to the silk by means of the cremastral hooks. The larvae are found in July and pupate early in August.

Genus ABBOTANA Hulst.

Body of usual type; surface always dull in appearance with deep impressed lines on the head, thorax, and appendages, and densely punctate on the abdomen; cephalic end of body showing three small tubercles between the antennae; labial palpi represented by a small polygonal area caudad of the labrum, proximolateral angles of the maxillae never reaching the eye-pieces; maxillae and antennae reaching the caudal margin of the wings; prothoracic legs two-thirds the length of the wings, the femora never exposed; mesothoracic legs a little shorter than the maxillae and never reaching the caudal margin of the wings; both prothoracic and mesothoracic legs extending cephalad between the sculptured eye-piece and the antenna; mesal length of prothorax one-half that of the mesothorax; that of the metathorax shorter than the first abdominal segment; mesothoracic spiracles slit-like, showing a narrow very slightly elevated ridge along the caudal margin; abdominal segments 1 to 8 punctate, the tenth segment irregularly rugose; furrow on the dorsum between the ninth and tenth segments distinct, the caudal margin coarsely toothed, the lateral extensions never reaching to the base of the cremaster; cremaster longer than the tenth segment, bearing two very stout spines at the distal end and slender hooked setae along each lateral margin, the ventral surface with a deep furrow on each side.

This genus includes a single species *Abbotana clemataria* found throughout the eastern part of the United States.

ABBOTANA CLEMATARIA Smith and Abbot.

Color chestnut brown, variously mottled with very dark brown or black, the darker color always conspicuous around the

spiracles and on the cremaster; head, as seen in ventral view, with three small tubercles along the cephalic margin, one on the meson, and one on each side of it; face-parts and appendages not elevated, except the cephalic fourth of each antenna which shows a low ridge along the median line, the tubercles on the ridge causing the lateral margins of the head to appear serrate; antennae covered with minute tubercles; prothorax with a slightly elevated median ridge which is almost always lighter in color than the remainder of the segment; middle line of mesothorax usually marked by a pale yellowish line; abdominal segments 1 to 8 densely punctate, the ninth practically smooth, the tenth segment and cremaster irregularly rugose; spiracles ovate in outline, the openings elliptical; spiracular furrows of the fifth abdominal segment indistinct, very slightly elevated and interrupted by punctures; cremaster triangular, with two heavy curved spines at the distal end, each about 6 mm. long, and three hooked setae along each lateral margin.

Length 18 to 23 mm.; greatest width 7 mm.

The larvae of this species were the largest of any geometrid collected in Maine being about three inches long. They are dark brown to nearly black in color, with a prominent ridge on the mesothorax and one near the caudal end of the body. These ridges have a small orange tubercle at each side. Near the middle of the body is a very prominent brown tubercle on each side the meson, resembling the winter buds of the maple tree, so that when this larva mimics a twig, these tubercles pass for buds. They were collected from apple and maple, but are said to feed on a variety of trees. When ready to pupate, the larvae spin a few threads of silk and draw two leaves together and the pupa fastens the hooks on the cremaster into this silk. The larvae were most numerous the latter part of July, and the first one pupated August 10. The adults emerge in the spring. The pupae of this species resemble those of the genus *Sabulodes* very strongly, so no figure is shown. They differ, however, in the tubercles on the head and antennae, and in the irregularly rugose cremaster and tenth abdominal segment, and in never having any portion of the prothoracic femur exposed. The pupae of *Abbotana* never become hard and firm as most pupae do, but are always soft and yielding to the touch. They are normally much larger than those of *Sabulodes*.

Genus CLEORA Curtis.

Body of usual type; face-parts not much elevated; antennae reaching the caudal margin of the wings, the distal end of each curved slightly mesad; a small portion of the labial palpi exposed caudad of the labrum; maxillae reaching almost to the caudal margin of the wings, the proximo-lateral angles not extending quite to the eye-pieces; prothoracic legs three-fourths the length of the wings, their femora exposed; mesothoracic legs equal in length to the maxillae; mesal length of prothorax two-fifths that of the mesothorax, mesothoracic spiracle with an ovate tubercle adjacent to its caudal margin, the surface covered with fine setae; mesal length of metathorax one-fourth that of the mesothorax; first eight abdominal segments coarsely punctate; the spiracular furrow present cephalad of each spiracle on the fifth abdominal segment, the surface of the furrow very rugose; dorsal furrow never present between segments nine and ten; abdominal spiracles almost circular in outline; cremaster triangular at base, the distal half spine-like, and slightly bifurcate at tip.

This genus includes a number of species but only two are commonly found in Eastern North America. One of these *Cleora pampinaria* is described here.

CLEORA PAMPINARIA Guenée.

Fig. 2, F and I.

Color chestnut brown, usually without markings, sometimes with a few small dark spots on the appendages; face-parts and appendages almost smooth and appearing polished; prothoracic leg slightly elevated near the large exposed part of the femur; thorax smooth, or with very fine transverse impressions; abdomen densely punctate with medium punctures on the first eight segments; spiracles almost circular, the openings elliptical, that of the sixth slightly ventrad of the others; spiracular furrow (Fig. 2, I) with the surface deeply rugose, the outer edge heavily chitinized, almost black and apparently serrate; surface slightly concave between the furrow and spiracle, crossed by faint elevated lines; cremaster about 1 mm. long, the dorsal surface convex and rugose, the distal end spine-like and bifurcate.

Average length 12.5 mm.; greatest width 4 mm.

It could not be determined from the specimens whether or not there are hooked setae on the cremaster as they stayed in the soil until the moths emerged, and if present were broken off. The larvae of this species were collected from common yellow dock the latter part of June and pupated before a description was obtained. The moths emerged during September in the laboratory.

Genus DIASTICTIS Hübner.

Body of usual shape, widest in the region of the third and fourth abdominal segments; head, thorax and appendages comparatively smooth, the abdomen rather coarsely punctate; frontoclypeal suture indicated at the base of the antennae; labrum rounded on the caudal margin; a small portion of labial palpi exposed caudad of the labrum; maxillae never quite reaching the caudal margin of the wings, the proximo-lateral angles not extending to the eye-pieces; antennae broader than the prothoracic legs, narrowed slightly at the distal end and sometimes touching on the meson; prothoracic legs three-fourths the length of the wings, their femora exposed; mesothoracic legs as long as the maxillae; tips of the metathoracic legs usually exposed caudad of the maxillae; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracle with a prominent ridge adjacent to its caudal margin, the edge curved slightly caudad and covered with white setae; metathorax one-half the length of the prothorax; abdominal segments 1 to 8 thickly punctate, the ninth and tenth sparsely punctate or smooth; abdominal spiracles elliptical; fifth abdominal segment with five or six shallow furrows over each spiracle, the margin of the segment cephalad of the spiracle with coarser punctures than the remainder of the segment; dorsal furrow never present between the ninth and tenth abdominal segments; cremaster rugose at base, bifurcate at the distal end.

Only two species of this genus were collected in Maine, but other species are known to occur in the State. These two species are very closely related and may be separated as follows:

a. Elevation along caudal margin of mesothoracic spiracle strongly elevated and visible in ventral view; spiracular

furrows indistinct and often resembling rows of confluent punctures. *ribearia.*

aa. Elevation along caudal margin of mesothoracic spiracle strongly elevated and not visible in ventral view; spiracular furrows narrow, but distinct, the edges sharp. *anataria.*

DIASTICTIS RIBEARIA Fitch.

The Gooseberry Span-worm. Fig. 3, F, and Fig. 4, I and J.

Color dark reddish brown; head, thorax and appendages usually smooth and polished, occasionally with indeterminate transverse striations, especially on the thorax; antennae with transverse impressions indicating the segmentation, usually as long as the wings but seldom meeting on the meson; a distinct, transverse furrow present between the invaginations for the anterior arms of the tentorium; eye-pieces almost equal in width; elevation caudad of the mesothoracic spiracle prominent, and visible in ventral view, the surface thickly covered with fine whitish setae; spiracular furrows of the fifth abdominal segment indistinct and resembling confluent punctures; cremaster 1 mm. in length, rugose and bifurcate for about one-fourth its length.

Length 10 to 12 mm.; greatest width 3.5 mm.

The larvae feed on leaves of gooseberry, currant and blueberry. They are more often found on the gooseberry and often become a serious pest. The larvae are whitish, irregularly spotted with black and have yellow stripes on the dorsal and lateral aspects. They are full-grown about the last of June and enter the ground to pupate, but do not spin a cocoon. The moths emerge from the pupae in two or three weeks and lay their eggs which hatch the following spring.

DIASTICTIS ANATARIA Swett.

Fig. 4. G and H.

Color dark reddish brown, head, thorax and appendages with fine indeterminate transverse striations, but giving a smooth and polished appearance; antennae as long as the wings and meeting on the meson at their caudal margin; a transverse furrow indicated between the invaginations for the anterior arms

of the tentorium, but not deep nor very distinct; eye-pieces difficult to distinguish; elevation caudad of the mesothoracic spiracle not prominent and not visible in ventral view, its surface sparsely covered with whitish setae and not very noticeable, a small furrow just caudad of the elevation; spiracular furrows of the fifth abdominal segment distinct, narrow, five or six in number and punctate at the bottom of the furrows; cremaster 1.3 mm. in length, with a distinct transverse furrow at base, rugose on the proximal half, the furrows deeper on the ventral surface, and bifurcate for one-fifth its length.

Length 10 to 12 mm.; greatest width 3.5 mm.

The larvae of this species were collected on gray birch and yellow birch. They were about an inch long, colored dull red, marked with black in an irregular marbled pattern with a whitish spot in front of each spiracle. They were collected the last week of June and were ready to pupate in about two weeks. In the laboratory they pupated on top of the soil without forming a cocoon, but would probably burrow in the soil out of doors. The adults emerged July 25.

Genus HYDRIA Hübner.

Head short, slightly narrower than the thorax; body surface slightly roughened with impressed lines and punctures, but presenting a polished appearance; epicranial suture present and distinct; labrum broader than long, rounded at the distal end; a small triangular portion of the labial palpi usually visible caudad of the labrum; maxillae sometimes reaching the caudal margin of the wings, but usually slightly shorter and exposing the tips of the metathoracic legs, the proximo-lateral angles never extending as far as the eye-pieces; antennae always reaching the caudal margin of the wings; prothoracic legs almost three-fourths the length of the wings, their femora always exposed; mesothoracic legs usually slightly shorter than the antennae; both prothoracic and mesothoracic legs extending cephalad between each sculptured eye-piece and the antenna; mesal length of prothorax two-fifths that of the mesothorax; metathorax about half the length of the prothorax and shorter than the first abdominal segment; mesothoracic spiracles slit-like; abdomen coarsely punctate, except on the ninth and tenth seg-

ments; dorsum of fifth abdominal segment with a deep furrow along the cephalic margin, invisible when the body is contracted and the movable segments telescoped; abdominal spiracles slightly produced, the openings elliptical; dorsal furrows present between the ninth and tenth abdominal segments, its caudal margin finely serrate, the lateral extension reaching caudad almost to the base of the cremaster; cremaster about twice the length of the tenth segment, a slight furrow at base, bifurcate at tip and with hooked setae near the proximal end.

HYDRIA UNDULATA Linnaeus.

The Scallop-shell Moth. Fig. 4, A and D.

Color reddish brown; ventral surface of head and appendages with shallow, impressed lines, labrum slightly elevated; thoracic segments with irregular, deeply impressed lines; metathorax and first abdominal segment showing a rather prominent ridge along the caudal margin, abdomen with the first four segments coarsely punctate except a narrow strip along the caudal margin, dorsum of fifth segment almost smooth caudad of the furrow which is edged with black; sixth, seventh and eighth segments like the first four, the ninth and tenth practically smooth; cremaster rugose at base, narrowing rapidly to a slender spine like part which is bifurcate at tip, the arms of the bifurcation slender and divergent, lateral margin of cremaster with three slender hooked setae along each lateral margin.

Average length 9 mm.; greatest width 3 mm.

The larvae of the scallop-shell moth feed mostly on cherry. They are dark brown or nearly black on the back with some fine yellow lines, and yellowish white underneath. They make a sort of nest by webbing the leaves together at the end of a branch and adding more leaves as they need food. The larvae were collected August 26 and soon after entered the soil to pupate. They form an earthen cell in which the pupa passes the winter.

Genus PALEACRITA Riley.

Body of usual type, but usually strongly convex on the dorsum of the first three abdominal segments, so that the body

is very thick in this region; face-parts decidedly elevated at the proximal ends of the antennae, clypeal region, labrum and eye-pieces; a furrow present indicating the lateral parts of the fronto-clypeal suture; labrum almost semicircular in outline; antennae reaching the caudal margin of the wings, the distal end of each curved slightly mesad; maxillae reaching the caudal margin of the wings, their proximo-lateral angles not extending as far as the eye-pieces; labial palpi never exposed; prothoracic leg reaching cephalad between the sculptured eye-piece and antenna, and at least seven-eighths the length of the wings, their femora never exposed; mesothoracic legs sometimes reaching the caudal margin of the wings, but usually a little shorter; thoracic segments unusually short, the entire thorax less than one-fourth the total length of the body; mesal length of prothorax two-thirds that of the mesothorax, and the metathorax one-half of this length; mesothoracic spiracle with its caudal margin abruptly elevated, then a gradual slope towards the base of the wing; abdomen coarsely punctate, at least on eight segments; dorsal furrow never present between the ninth and tenth segments; abdominal spiracles strongly produced, the openings somewhat lenticular; one deep spiracular furrow present over each spiracle on the fifth segment, the outer margin strongly chitinized; cremaster longer than broad, slightly bifurcate at tip often showing a fine seta on each lateral margin near the proximal end.

This genus has only one common species, *Paleacrita vernata* which is common in the eastern part of the United States and Canada.

PALEACRITA VERNATA Peck.

The Spring Canker-worm. Fig. 3, C and D.

Color yellowish or reddish brown; head, thorax, and appendages slightly roughened with indeterminate transverse striations; a portion of the front more strongly elevated than the remainder of the face-parts; antennae showing transverse impressions; abdomen coarsely punctate on segments 1 to 8, rarely on the remaining segments; abdomen considerably arched in the region of the first three segments giving the pupa a humpbacked appearance; spiracular furrows with their transverse

length twice that of the spiracles; spiracles usually black or dark brown and produced for a distance equal to their length; a prominent projection usually present on each side of the anal opening, probably the scars of the anal prolegs; cremaster less than 1 mm. in length, usually triangular at base narrowing rapidly so that the distal end is cylindrical and spine-like, slightly bifurcate at tip; lateral setae of the cremaster very fine and easily broken and not usually found on specimens.

Average length 8 mm.; greatest width 3.5 mm.; height at third abdominal segment 3 to 3.5 mm.

The larvae of the spring canker-worm are about an inch long and vary considerably in color from light brown to dull black. There is a yellow stripe running through the spiracles and a greenish yellow stripe underneath. They are ready to pupate about the first of June and enter the ground where they make an earthen cell and change to pupae. They live over winter in the pupal stage, the moths emerging in early spring. Although the female moths of this species are wingless, the pupae have the wings as well developed in the female as in the male.

Genus ERANNIS Hübner.

Cephalic half of body much thicker than the remainder, the dorsum of the first three segments convex as seen in lateral view; fronto-clypeal suture distinct for a part of its distance; clypeal and labral regions distinctly elevated, the labrum almost semi-circular in outline; labial palpi not visible; maxillae never quite reaching the caudal margin of the wings, the proximo-lateral angles never reaching the eye-pieces; antennae considerably broader than the prothoracic legs and only slightly narrowed at the distal end, always reaching the caudal margin of the wings and there curving mesad and normally touching; prothoracic legs at least seven-eighths the length of the wings, the femora never exposed, the cephalic end extending between the antenna and the sculptured eye-piece; mesothoracic legs as long as the maxillae and almost reaching the caudal margin of the wings; prothorax one-half the length of the mesothorax, the caudal margin not prominently curved at the meson; mesothoracic spiracles with a prominent ovate flattened tubercle adjacent to its caudal margin, the surface rugose and apparently covered with very fine, short setae, the tubercle extending at least

one-fourth of the distance between the margin of the antenna and the meson; mesothorax shorter than usual, the metathorax about one-fourth of its mesal length; abdominal segments 1 to 8, sometimes 1 to 9, punctate, the remaining segments smooth; abdominal spiracles almost circular in outline, the openings elliptical, the lips somewhat elevated; spiracular furrows present on the fifth segment, each with a strongly chitinized edge, the surface punctate, the area surrounding the spiracle having few punctures; dorsal furrow present between the ninth and tenth abdominal segments, the edges not strongly toothed; cremaster broad at base, and rugose, narrowing rapidly to a smooth spine-like distal half which is bifurcate at tip.

ERANNIS TILIARIA Harris.

The Lime Span-worm. Fig. 3, A and B.

Color usually bright reddish or yellowish brown, the head, thorax, and appendages often darker than the remaining surface; face parts with fine indeterminate striations, almost smooth, a few wrinkles or impressed lines between the proximal ends of the antennae; thorax with shallow impressed lines; abdominal segments 1 to 8 coarsely, thickly punctate; eighth segment somewhat swollen in the region of the spiracles and narrowing rapidly to the caudal margin; caudal margin of the furrow between the ninth and tenth segments finely serrate and somewhat crenulate in outline; cremaster with a transverse furrow at base, the proximal half rugose with a slight lateral projection on each side at the base of the narrow, smooth distal portion, which is bifurcate at tip, each half slender and somewhat seta-like, very easily broken.

Average length 12 to 15 mm.; greatest width 4 to 5 mm.

The larvae of the lime span-worm were collected this season from apple, cherry, Carolina poplar and the linden or lime tree, although most of them came from apple. The caterpillars are about an inch and a half long, and the markings vary considerably. They are generally dull dark red on the back, with a broad yellow stripe through the spiracles, and whitish underneath. They were most abundant the last two weeks of June and pupated the last of June and the first week in July. They burrow into the soil near the base of the tree to pupate and

make an earthen cell, but no traces of cocoons were found. The adults emerge late in the fall and lay the eggs, which do not hatch till spring.

Family NOTODONTIDAE.

The pupae of this family vary considerably, and there is no one character which will serve to separate them from those of the nearly related families. The prothoracic and mesothoracic legs are of the normal length for lepidopterous pupae, the prothoracic legs about half that of the wings and the mesothoracic legs slightly longer. The labial palpi often show a very small portion caudad of the labrum. The maxillae seldom reach the caudal margin of the wings and are usually less than three-fifths their length. The antennae are broadest at their proximal ends, and there the width exceeds that of the prothoracic legs. They seldom reach the caudal margin of the wings, and their tips often lie adjacent on the meson caudad of the other appendages. The mesothoracic leg never reaches cephalad to the eye-pieces, but the prothoracic leg always does. The latter seldom extends cephalad between the sculptured eye-piece and the antenna. The abdomen is usually punctate and only shows a dorsal furrow between the ninth and tenth segments in the genus *Datana*. The mesothoracic spiracles are usually slit-like and seldom, if ever, show an elevated ridge or tubercle adjacent to the caudal margin. The abdominal spiracles are seldom produced and always in a straight line. Spiracular furrows are never present. A few members of this family have no cremaster, but usually a short cremaster is present. The presence of hooked setae on the cremaster is the exception in the Notodontidae, as most of them pupate in the ground.

The colors vary but little in this family, nearly all being chestnut-brown, but a few are nearly black. None of the species known have prominent markings on the body. The genera of Notodontidae may be separated as follows:

a. Maxillae one-third or less the length of the wings; both prothoracic and mesothoracic legs meeting on the meson caudad of the maxillae; abdomen very finely punctate.

b. Thorax and abdomen thickly covered with very fine short setae; cremaster a stout spine about one millimeter in

length with two short recurving hooks at the tip; each of which bears two or more very fine setae.

Melalopha.

bb. Thorax and abdomen never thickly covered with very fine, short setae; cremaster never as described above; sometimes absent.

c. Abdominal segments 2 to 7 with a slight ridge at both cephalic and caudal margins, the cephalic ridge interrupted by deep pits giving it the appearance of a row of square tubercles; face-parts and appendages not elevated, making a smooth even surface; cephalic end of body not elevated between the antennae; cremaster short. *Apatelodes.*

cc. Abdominal segments 2 to 7 never with ridges; appendages distinctly elevated; cephalic end of body elevated between the antennae; cremaster never present. *Harpyia.*

aa. Maxillae always more than one third the length of the wings; never with both prothoracic and mesothoracic legs meeting on the meson; abdomen usually rather coarsely punctate.

b. Maxillae from one half to three-fifths the length of the wings; mesothoracic legs meeting on the meson caudad of the maxillae; appendages roughened with deep indeterminate striations; abdomen coarsely punctate; a distinct, deep furrow on the dorsum between the ninth and tenth abdominal segments; cremaster short, bifurcate, each half with several short, spiny projections.

Datana.

bb. Maxillae more than three-fifths the length of the wings; neither prothoracic nor mesothoracic legs meeting on the meson caudad of the maxillae; appendages usually with shallow striations; a distinct furrow never present on the dorsum between the ninth and tenth abdominal segments; cremaster not as described above.

c. Entire body surface with coarse deep punctures; cephalic margin of the movable abdominal segments with large lunate punctures and a ridge with a row of large distinct punctures just caudad of it; cremaster short, rugose, slightly bifurcate; bearing six

long hooked setae; mesothorax never with a deeply pitted caudal margin. *Symmerista.*

cc. Body usually punctate on the abdomen but not on the appendages; movable abdominal segments sometimes with a slight ridge along the cephalic margin but never with a row of large punctures just caudad of it; cremaster bifurcate, but never with hooked setae; mesothorax with a row of deep pits along the caudal margin, with smooth quadrangular areas between and partly covering them.

d. Wings always touching on the meson; maxillae never as long as the wings; cephalic end of body sometimes with two sharp, heavily chitinized projections. *Schizura.*

dd. Wings adjacent on the meson but not touching; maxillae usually as long as the wings; cephalic end of body never with heavily chitinized projections. *Heterocampa.*

Genus MELALOPHA Hübner.

Body cylindrical, blunt at the cephalic end, the head scarcely visible in dorsal view; surface smooth, polished, covered with very fine setae which are only visible by the aid of a lens; epicranial suture present but only a small portion visible, the vertex being represented by a small triangular area adjacent to each antenna; labrum usually broader than long; sculptured eye-piece more than twice the width of the glazed eye-piece; antennae broader at the proximal end than the prothoracic legs and tapering gradually to a pointed tip; labial palpi usually entirely concealed, but occasional specimens show a small portion just caudad of the labrum; maxillae one-third or less the length of the wings, the proximo-lateral angles never reaching the eye-pieces; legs of the normal length, both prothoracic and mesothoracic legs adjacent on the meson caudad of the maxillae, and a very small portion of the metathoracic legs showing between the wings at their caudal margin; thorax relatively short, only about one-fourth the length of the body; mesal length of prothorax two-fifths that of the mesothorax; metathorax shorter than the first abdominal segment; spiracles all slightly elevated,

their openings elliptical; abdomen finely punctate; cremaster a straight spine with the distal end widened and bearing two or three recurving hooks on each side, each hook bearing minute setae on its mesal margin which are very easily destroyed.

MELALOPHA INCLUSA Hübner.

Fig. 5, C and I.

Color usually yellowish brown, with darker brown on the thorax, the cephalic margin of the abdominal spiracles, the cephalic margin of the movable abdominal segments and the cremaster; antennae smooth, ending opposite the prothoracic legs; maxillae one-third the length of the wings or slightly less; first three segments of the abdomen usually more elevated than the thorax and forming a distinct curve; abdominal segments finely punctate, the cephalic margin of each movable segment much more densely punctate, the ninth and tenth segments almost smooth; first abdominal segment with the scar of the larval tubercles apparent, in some specimens as a dark spot on each side of the meson, in others a small, but distinct tubercle in the same position; cremaster (Fig. 5, I) 1 mm. in length, with either two or three recurving hooks on each side.

Length 13 to 16 mm.; greatest width 5 mm.

The larvae of this species feed on poplar. Several of the larvae live together in a sort of tent formed by drawing two or three leaves together with threads of silk. They spin a loose cocoon, placing it among the leaves in captivity, but no cocoons were found during the summer's collecting.

Genus APATELODES Packard.

Cephalic half of body to the caudal margin of the wings wider and thicker than the caudal half, which tapers gradually to the short blunt cremaster; body surface highly polished, none of the face-parts or appendages prominently elevated so that the surface is smooth and even; epicranial suture present, but faint; vertex about twice as long at lateral margin as at meson; frontoclypeal suture sometimes indicated by an impressed line; cephalic margin of labrum about twice the width of the caudal margin; labial palpi represented by a small pentagonal area just

caudad of the labrum; antennae broader at the proximal end, where they slightly exceed the width of the prothoracic legs, and tapering gradually to a pointed tip; maxillae one-third the length of the wings, their proximo-lateral angles separated from the eye-pieces by almost the width of the latter; legs of about the usual length, the prothoracic legs adjacent on the meson caudad of the maxillae for a distance equal to the length of the maxillae; mesothoracic legs meeting just caudad of the prothoracic ones; wings adjacent on the meson for a short distance caudad of the mesothoracic legs; mesal length of the prothorax slightly more than half that of the mesothorax which is shorter than usual in the notodontids; metathorax equal in length to the first abdominal segment; abdomen very finely, sparsely punctate, some of the segments with a flanged plate or ridge along the cephalic margin which is interrupted by deep pits, segments 4 to 6 with a similar plate along the caudal margin not interrupted by pits; cremaster, if present, very short, rough, and usually blunt.

APATELODES TORREFACTA Smith and Abbot.

Fig. 6, G.

Color very dark reddish brown; head usually smooth and highly polished, sometimes roughened around the labrum; antennae ending slightly cephalad of the prothoracic legs; thorax with a few impressed lines and punctures; prothorax always with a small group of punctures in the caudo lateral angle near the spiracle; mesothoracic spiracle with an elevated caudal margin and caudad of this a slight depression; abdominal segments 2 to 7 with an elevated cephalic ridge interrupted by pits, and sparsely covered with very fine punctures and a few striations in the spiracular region; segments 8 to 10 with a very few punctures; cremaster very short, less than 1 mm., rugose and scarcely bifurcate at tip.

Length 20 to 22 mm.; greatest width 9 mm.

The larva of this species has been taken in Maine on ash, beach, plum, oak, sassafras and various species of Rubus. It is very hairy, somewhat like a "woolly bear" and light grey in color with two long pencils of hairs on the thorax and one on the eighth abdominal segment. It enters the ground to pupate

and there makes an earthen cell. The pupa is easily recognized by the peculiar "bordered" appearance of the abdominal segments.

Genus HARPYIA Ochsenheimer.

Body distinctly depressed, elliptical in outline; front elevated at meson to accommodate the slight crest of the adult; frontoclypeal suture indicated laterad by a slight furrow; invaginations for the anterior arms of the tentorium large and distinct; clypeolabral suture indicated by a furrow; labrum nearly as long as broad, the caudal margin slightly narrowed; genae elevated; antennae elevated with the proximal half almost twice the width of the prothoracic legs, then rapidly narrowing to about one-fourth of this width, ending slightly caudad of the prothoracic legs; maxillae one-third the length of the wings; prothoracic and mesothoracic legs of the usual length and both meeting on the meson caudad of the maxillae; wings meeting on the meson caudad of the mesothoracic legs; mesal length of the prothorax slightly more than half that of the mesothorax, and that of the metathorax one-sixth that of the mesothorax; abdominal segments punctate; no cremaster present.

HARPYIA BOREALIS Boisduval.

Fig. 5, J.

Color reddish or yellowish brown; surface smooth and dull; head, thorax and appendages with fine striations more prominent on the prothorax and front; antennae with a row of minute tubercles along the middle line; maxillae with the proximolateral angles separated from the eye-pieces by a distance equal to the width of the eye-pieces; prothorax with a protuberance at each cephalo-lateral angle, probably indicating the scar of larval protuberances; mesothoracic spiracle slit-like; abdomen finely, sparsely punctate on the dorsum of the first eight segments, the remainder of the surface smooth; spiracles lenticular, usually margined by a black line.

Length 16 to 18 mm.; greatest width 7 mm.

The larvae of this species have been taken in Maine from poplar.

The larvae of this species belong to the group popularly known as horntails, on account of the long tail-like projections from the caudal end of the body. *Harpyia borealis* has two of these. The body is yellowish in color, the dorsal part nearly all dark brown. They feed on wild cherry. The larvae are found early in September and pupate about the last of the month. The cocoon is very thick and tough and usually spun against the side of the tree, where it resembles an excrescence on the bark.

Genus DATANA Walker.

Body always with an elevation at the cephalic end between the proximal ends of the antennae evidently to accommodate the crest of the imago; front prominently elevated, the elevation roughened with deep transverse striations and deeply punctate along the lateral margins; labrum also elevated, more prominently on the cephalic half; mandibular area sometimes elevated; glazed eye-piece always very narrow, scarcely more than a line along the mesal margin of the sculptured eye-piece; antennae at proximal end wider than the prothoracic legs and tapering gradually to a pointed tip, usually about two-thirds the length of the wings; maxillae from one-half to three-fifths the length of the wings, the proximo-lateral angles extending to the eye-pieces; labial palpi entirely concealed; legs of the usual length, the mesothoracic pair always meeting on the meson caudad of the maxillae; wings always adjacent on the meson caudad of the mesothoracic legs; mesothorax shorter than usual so that the thoracic segments are only one-fourth the total length of the body; mesal length of the prothorax one-half that of the mesothorax, the metathorax about one-sixth of the same length; thorax and abdomen always punctate; dorsum of abdomen always showing a deep furrow between segments nine and ten, its caudal margin serrate; cremaster short, bifurcate, each half bearing two or more short spinous projections.

There are at least four species of *Datana* found in Maine, and two of these *Datana ministra* and *Datana integerrima* may become serious pests. The other two species are comparatively rare as far as our records for the state show. While the pupae of this genus are very distinctive, the species are very closely related and the characters available for their separation are

somewhat variable. The teeth on the furrow between the ninth and tenth abdominal segments vary considerably, but in general follow the same arrangement. The following table may serve to separate the species:

a. Prothoracic legs always extending as far caudad as the maxillae, or meeting on the meson caudad of them; furrow between the ninth and tenth abdominal segments with the teeth on the caudal margin all short and approximately of equal length; pupae normally less than 20 mm. in length.

b. Dorsum of tenth abdominal segment not punctate; caudal margin of the furrow between the ninth and tenth abdominal segments scarcely elevated; surface usually shining and polished. *angusii.*

bb. Dorsum of tenth abdominal segment punctate as the remaining segments except perhaps a small area near meson; caudal margin of the furrow between the ninth and tenth abdominal segments always considerably elevated; surface dull. *integerrima.*

aa. Prothoracic legs not extending as far caudad as the maxillae, at least 1 mm. apart; furrow between the ninth and tenth abdominal segments with the teeth on the caudal margin uneven, and longer near the meson; pupae normally over 20 mm. in length.

b. Crest on the front with a prominent longitudinal carinate ridge on the meson and a distinct furrow on each side; abdomen with medium punctures; each half of the cremaster with three projections. *major.*

bb. Crest on the front without longitudinal ridges or furrows; abdomen with large shallow punctures; each half of the cremaster with two projections. *ministra.*

DATANA ANGUSII Grote and Robinson.

Fig. 5, D and E.

Color bright reddish brown; crest prominent, always rugose with deep transverse striations and punctures, and usually with two longitudinal furrows; face-parts and appendages with transverse striations, much shallower than those of the crest

and not noticeably punctate; antennae ending just cephalad of the mesothoracic legs; maxillae slightly more than half the length of the wings, usually about four-sevenths; prothoracic legs normally ending opposite the maxillae; cephalic margin of prothorax considerably elevated as seen in lateral view; prothorax with a distinct median carinate ridge, a similar but less prominent ridge on the metathorax; abdomen with medium punctures, larger along the cephalic margin of the movable segments; the surface irregular with fine ridges and some irregular depressions so that it does not appear even; first three abdominal segments broadly elevated along the meson; furrow between the ninth and tenth abdominal segments without prominent teeth, the teeth all about the same size; ninth abdominal segment with few punctures, the tenth smooth; each half the cremaster (Fig. 5, E) with a large, rather blunt mesal projection and a smaller, more pointed lateral one.

Length 15 to 18 mm.; greatest width 5 mm.

The larvae of this species feed on walnut and hickory. They pupate in the ground, each larva making a somewhat oval cell, without spinning a cocoon.

DATANA MAJOR Grote and Robinson.

Fig. 5, F.

Color bright reddish brown; crest very prominent with two longitudinal furrows and deep transverse striations, the lateral margins punctate; face-parts and appendages with irregular, transverse striations and depressions; antennae meeting on the meson caudad of the mesothoracic legs; maxillae slightly more than half the length of the wings; prothoracic legs much shorter than the maxillae; mesothoracic legs meeting on the meson just caudad of the maxillae; cephalic margin of prothorax not elevated; prothorax and metathorax very slightly elevated along the meson; abdomen rather coarsely punctate and with small indeterminate depressions, both transverse and longitudinal; furrow between the ninth and tenth segments edged with black, the caudal margin elevated and with uneven teeth; both ninth and tenth abdominal segments punctate like the remaining segments; each half of the cremaster (Fig. 5, F) with three equal projections.

Length 25 to 27 mm.; greatest width 8 mm.

The larvae of this species feed on certain species of Vaccinium, the common blueberries and deerberry, also on Andromeda. As its name implies it is the largest species of the genus. The method of pupation is probably the same as for the other species of *Datana*, but it has not been observed by the writer.

DATANA INTEGERRIMA Grote and Robinson.

Fig. 5, G.

Color dark brown; crest not very prominent, the longitudinal furrows not deep or well defined; face-parts and appendages very rough with impressed lines and other surface sculpturing; antennae never meeting on the meson nor extending as far caudad as the mesothoracic legs; maxillae about one-half the length of the wings and slightly longer than the prothoracic legs; mesothoracic legs meeting on the meson caudad of the maxillae; median line of the prothorax and metathorax slightly elevated; thorax noticeably punctate among the transverse striations; abdominal segments rather finely punctate, with few other markings; furrow between the ninth and tenth segments edged with black, the caudal margin elevated and almost evenly toothed; both ninth and tenth abdominal segments punctate; each half of the cremaster with three short, almost equal projections.

Length 17 to 19 mm.; greatest width 6 mm.

The larvae of this species feed on walnut, hickory and oak. They are found in large companies and always keep together while feeding. They pupate in the ground.

DATANA MINISTRA Walker.

Fig. 5, H.

Color bright reddish brown, sometimes yellowish brown; crest on front seldom showing longitudinal furrows; face-parts and appendages rugose with indeterminate transverse striations, the appendages less rugose than the face-parts; maxillae three-fifths the length of the wings or a trifle shorter, always longer than the prothoracic legs; cephalic margin of prothorax slightly

elevated; median line of prothorax and metathorax slightly elevated but not carinate; abdomen coarsely punctate, the punctures larger along the cephalic margin of each movable segment, and with scarcely any other markings; furrow between segments nine and ten edged with black, the teeth coarse and largest near the meson; caudal margin of furrow elevated; eighth and ninth abdominal segments always punctate; cremaster usually with two short spinous projections on each half.

Length about 23 mm. varying but little; greatest width 7 mm.

Most larvae of *Datana ministra* have been collected from apple in this state, although it feeds on a variety of other trees. The larva enters the ground to pupate. It spins no cocoon, but forms an earthen cell in which silk threads are seldom present.

Genus SYMMERISTA Hübner.

Head distinctly narrower than the thorax; body surface punctate, even on the appendages, though presenting a polished appearance, and without impressed lines or other markings; clypeal region slightly elevated; invaginations for the anterior arms of the tentorium very distinct; labrum almost semicircular in outline; glazed eye-piece one-fourth the width of the sculptured eye-piece and bounded mesally by an impressed black line; maxillae about nine-tenths the length of the wings, the tips of the antennae meeting just caudad of them on the meson; antennae considerably wider at the proximal end, but their greatest width is not equal to that of the prothoracic leg; prothoracic and mesothoracic legs of the usual length, never meeting on the meson; wings meeting on the meson for a short distance caudad of the antennae; mesal length of prothorax one-third that of the mesothorax and the metathorax one-fourth of the same length; cremaster short, slightly bifurcate, and bearing hooked setae.

SYMMERISTA ALBIFRONS Smith and Abbot.

Fig. 6, A and B.

Color dark chestnut-brown; mesal half of the genae and a small area adjoining the cephalic margin of the prothorax

highly polished and without punctures; punctures on the front black, and more irregular in outline than on the remainder of the body surface; mesothoracic spiracles with both margins elevated, the caudal margin slightly more so than the cephalic, and black in color; movable abdominal segments with the cephalic margin more densely punctate than the remainder and with large lunate punctures; cephalic margin separated from the remainder of the segment by a distinct ridge, and just caudad of this a row of large black punctures; abdominal spiracles (Fig. 6, B) elevated along the cephalic margin, the openings somewhat crescent-shaped and directed caudad; cremaster less than 1 mm. in length, rugose with longitudinal ridges, each point of the bifurcation bearing three hooked setae.

Length 17 to 21 mm.; greatest width 5 to 7 mm.

The larvae of *Symmerista albifrons* are striped longitudinally with black and red and have a prominent red hump near the caudal end of the body. They spin a thin, tough cocoon between leaves, and are usually found on the surface of the ground under the tree on which the larvae fed. The larvae feed on oak and maple. They appear late in the season and pupate in September.

Genus SCHIZURA Doubleday.

Body of usual type, sometimes with a projection at the cephalic end; surface appearing smooth and polished; epicranial suture visible in some species; antennae with the greatest width greater than that of the prothoracic legs, narrowed rapidly and forming a long pointed tip, never quite reaching the caudal margin of the wings; maxillae always more than three-fifths the length of the wings, but never reaching their caudal margin, the caudo-lateral angles always reaching the glazed eye-piece, sometimes extending beyond; mesal length of prothorax one-half that of the mesothorax; mesonotum with a row of deep elongate pits along the caudal margin of the wings with smooth, square black areas between; metathorax with its mesal length about one-fourth that of the mesothorax; abdomen with the first eight segments punctate; cremaster entirely bifurcate, each half somewhat boot-shaped, the lateral margins of the cremaster subparallel.

The species of Schizura may be separated by the following table:

a. Maxillae always more than seven-eighths the length of the wings; cephalic end of body blunt and only slightly projecting between the antennae; abdominal segments 5 to 7 with the punctures distinctly larger and more numerous along the cephalic margin; body never with prominent tubercle scars on the dorsum of the mesothorax, metathorax, and first abdominal segments. *ipomeae.*

aa. Maxillae five-sixths the length of the wings; cephalic end of body with a prominent, slightly bifurcate projection; abdominal segments 5 to 7 with the punctures of approximately the same size and not much more numerous along the cephalic margin; body with prominent tubercle scars on the dorsum of the mesothorax, metathorax and first abdominal segment. *concinna.*

SCHIZURA IPOMEAE Doubleday.

Fig. 5, B.

Color bright yellowish brown; body with a slight projection at the cephalic end between the proximal ends of the antennae; epicranial suture visible for a short distance adjacent to each antenna in the majority of specimens; face-parts and appendages smooth and polished, with very few punctures or other surface markings; mandibular area slightly elevated; antennae ending just caudad of the mesothoracic legs, but never meeting on the meson; maxillae more than seven-eighths the length of the wings, the caudo-lateral angles always extending to the eye-pieces; sculptured eye piece distinguished by its impressed lines and slightly wider than the other; thoracic segments with a few fine punctures; mesothorax without punctures as in *S. concinna*, but with short, transverse, impressed lines on each side the meson; caudal margin of mesonotum with seven pits and six square black polished areas between; abdominal segments sparsely covered with very fine punctures except for a band along the cephalic margin of segments 5 to 7, which is densely and rather coarsely punctate; first abdominal segment often with a small rounded tubercle, or at least a tubercle scar on the meson showing the location of the prominent larval pro-

jection; abdominal spiracles slightly produced, the openings somewhat crescent-shaped; eighth abdominal segment with a dark tubercle scar on each side of the meson; cremaster about 1 mm. in length, the lateral margins subparallel, the mesal margins with two projections.

Length 15 to 20 mm.; greatest width 4 mm.

The larvae of this species has been collected only on maple, although it is reported from oak, elm and several other trees. The larvae enter the soil to pupate and there spin a thin cocoon which is covered with particles of sand or soil. The pupae of this species closely resemble those of certain species of *Heterocampa* notably *H. bilineata.*

SCHIZURA CONCINNA Smith and Abbot.

The Red-humped Apple-worm. Fig. 5, A.

Color chestnut brown; body with a prominent median cephalic projection which is slightly bifurcate; face-parts and appendages smooth and polished, without markings except for a few transverse impressions; antennae not extending as far caudad as the mesothoracic legs, which are usually 1 mm. longer; maxillae five-sixths the length of the wings; scars of larval projections prominent on each side the meson of the mesothorax, metathorax and first abdominal segment, where they often show as distinct tubercles, less prominent scars on the fourth abdominal segment, and occasionally scars visible on the other segments but usually not distinct; caudal margin of mesonotum normally with nine pits and eight square, black, polished areas between; abdominal segments rather densely punctate with punctures of medium size, the punctures on the cephalic margin of segments 5 to 7 differing very little from those on the remainder of the segment; abdominal spiracles large, slightly produced, the openings elliptical, the margins very dark brown; cremaster about one-half millimeter in length, bifurcate, each half oblong with a very slight projection at each angle and another on the mesal margin about half way to the distal end.

Length 10 to 12 mm.; greatest width 4 mm.

The red-humped apple caterpillar is often a serious pest in apple orchards. It also feeds on other fruit trees and a number of forest trees. The larvae feed mostly at the ends of the

branches and live in colonies. They have fine black and white longitudinal stripes on the body and near the cephalic end some short black projections with a prominent reddish hump on the fourth abdominal segment. They usually pupate under dead leaves and sticks at the base of the tree and begin to pupate the last of August or in the early part of September. They spin a very thin cocoon which is usually fastened between two dead leaves or some small sticks. There is only one brood in Maine and adults emerge from these pupae the following spring.

Genus HETEROCAMPA Doubleday.

Body slightly wider at the cephalic half, tapering gradually from the fourth abdominal segment to the cremaster; fronto-clypeal suture faintly indicated; labrum somewhat triangular in outline, much narrower on the caudal margin; glazed eye-piece about one-half the greatest width of the sculptured eye-piece; antennae more than seven eighths the length of the wings; maxillae usually as long as the wings, but sometimes a little shorter, the proximo-lateral angles extending laterad to the eye-pieces; prothoracic and mesothoracic legs visible and of the usual length; labial palpi never visible; wings adjacent on the meson below the maxillae but seldom touching; mesal length of prothorax about two-fifths that of the mesothorax; mesonotum with a row of deep pits along the caudal margin separated by smooth quadrangular areas; mesal length of metathorax one-fifth that of the mesothorax; abdominal segments punctate; cremaster bifurcate, each half somewhat boot-shaped.

HETEROCAMPA GUTTIVITTA Walker.

The Saddled Prominent. Fig. 6, C and D.

Color very dark brown, often almost black; surface smooth and polished; head, thorax and appendages slightly roughened with fine, rather close striations excepting the genae and glazed eye-pieces which are highly polished; maxillae slightly longer than the antennae but never quite reaching the caudal margin of the wings; pits along the caudal margin of the mesonotum normally eight, but occasionally with only seven; mesothoracic spiracle with a smooth, slightly elevated area adjacent to its

caudal margin which has a small semicircular depressed area in the middle; abdomen finely but not coarsely punctate, the punctures slightly larger along the cephalic margin of the segments; spiracles lenticular, slightly depressed; cremaster with the lateral margins subparallel, usually 1 mm. in length, sometimes shorter; a rugose area at base bounded cephalad by a narrow, irregular carinate ridge.

Length 18 to 22 mm.; greatest width 6 mm.

The larvae of this species feed on beech, maple, and many other trees. They often become very numerous and during the years 1908 and 1909 became a serious pest in Maine and New Hampshire. A description of the larvae and their life history is given in Bulletin 161 of the Maine Agricultural Experiment Station. The larvae when full grown pupate in an earthen cell, or among leaves at the base of the trees.

HETEROCAMPA BILINEATA Packard.

Color usually chestnut brown, sometimes darker; surface smooth and polished; head, thorax and appendages almost smooth, with a few slightly depressed lines; maxillae always reaching the caudal margin of the wings; pits along the caudal margin of the mesonotum usually eleven, occasionally only ten; mesothoracic spiracle with a very narrow elevation adjacent to the caudal margin, and caudad of this a slight depression; abdomen rather coarsely punctate on the cephalic margin, the punctures smaller and farther apart on the remainder of the segment; abdominal spiracles lenticular but not depressed; cremaster with the lateral margins distinctly converging to the tip, usually less than 1 mm. in length, never with a rugose area at base.

Length 16 to 20 mm.; greatest width 5 mm.

The larvae of this species have been collected in Maine from oak, elm and linden. The larva enters the soil to pupate, where it spins a loose web of silk to which the particles of soil adhere, forming a sort of earthen cocoon.

Family PLATYPTERYGIDAE.

This family consists of four genera, and pupae of only two of these have been seen. The larvae of *Oreta rosea* were col-

lected, but were not reared to maturity. The pupae of the two genera vary considerably in some respects, but are very similar in others. They have the maxillae very short, about one-third the length of the wings. The legs are of normal length, both the prothoracic and mesothoracic meeting on the meson caudad of the maxillae. The antennae are about the width of the prothoracic legs at their proximal end and are gradually narrowed towards the tip. They are slightly longer than the mesothoracic legs. The tips of the metathoracic legs are always exposed. The metathoracic wings are always visible on the ventral surface of the body. They meet on the meson caudad of the mesothoracic legs and then separate to show the metathoracic legs. They are also visible along the caudal margin of the mesothoracic wings. The thorax is of normal length and the mesothoracic spiracles are slit like. The abdomen is punctate, with a dorsal furrow present between the ninth and tenth segments. This furrow is never as well-defined as in the Geometridae. The abdominal spiracles are usually quite large and in a straight line. No spiracular furrows are present. A cremaster is always present and may or may not have hooked setae.

So far as known the members of this family do not pupate in the ground, but in a thin cocoon, or attached to a web of silk by the cremaster. The genera described here may be separated as follows:

a. Cremaster with prominent hooked setae; prothorax with a prominent median ridge which shows as a median cephalic projection on the ventral surface; body densely covered with whitish bloom. *Falcaria.*

aa. Cremaster without prominent hooked setae; prothorax without a prominent median ridge, the front having two prominent cephalic projections; body never with bloom on any part of its surface. *Drepana.*

Genus FALCARIA Haworth.

Body of usual shape, and densely covered with a whitish bloom; face-parts slightly elevated, an irregular tubercle on the front adjacent to the proximal end of each antenna; caudal portion of the clypeal region distinctly elevated to form a large rounded tubercle; prothoracic leg extending cephalad between

the sculptured eye-piece and the antenna; antennae about seven-eighths the length of the wings, the distal end of each curved slightly laterad, widest at the cephalic end where they exceed the greatest width of the prothoracic legs and narrowed gradually to half this width at the distal end; maxillae slightly more than one-third the length of the wings, the proximo-lateral angles never extending to the eye-pieces; labial palpi entirely concealed; prothoracic legs three-fifths the length of the wings, the distal third of their length meeting on the meson caudad of the maxillae; mesothoracic legs about five-sixths the length of the wings, and meeting on the meson caudad of the prothoracic legs for about the same distance; tips of the metathoracic legs showing on the meson between the wings; metathoracic wings exposed on the ventral surface, meeting on the meson just caudad of the mesothoracic wings and extending along the mesal margin of the mesothoracic wings to their caudal margin, and visible most of the way across to the lateral margin; prothorax with a prominent ridge on the meson, visible in ventral view; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracles slit-like; metathorax shorter than usual, its mesal length one-sixth that of the mesothorax; abdominal segments 1 to 8 with medium sized punctures and sparsely covered with small curved spines which are more numerous near the spiracles and the scars of the ventral prolegs, the transverse conjunctiva covered with small spines or spinous processes; body setae arising from the bases of the larger spines; dorsal furrow present between the ninth and tenth segments; abdominal spiracles slightly sunken, lenticular in outline, the openings elliptical; cremaster triangular in outline, longer than broad and ending in a group of stout hooked setae.

This genus includes a single species, *Falcaria bilineata*, found throughout the Atlantic states.

FALCARIA BILINEATA Packard.

Fig. 6, F and H.

Color dark brown, but covered with dense, rather flocculent, whitish bloom; head, thorax and appendages considerably roughened with indeterminate, transverse impressed lines; labrum somewhat quadrangular, the caudal margin slightly notched;

clypeal region elevated to form a prominent quadrangular tubercle bearing two prominent setae; tubercle at the proximal end of each antenna also bearing prominent setae; antennae tuberculate, the three rows of tubercles arranged transversely; surface of thorax more roughened than that of the head and with a small, irregular tubercle at the base of each important seta; dorsal furrow between the ninth and tenth abdominal segments distinct, the caudal margin not more strongly chitinized and toothed as in the Geometridae; tenth segment (Fig. 6, F) with a distinct V-shaped depression at the proximal end of the cremaster, the triangular area between considerably more elevated than the remainder of the segment; cremaster triangular in outline, rugose, the lateral margins convex, and narrowed to a rounded tip, then flaring suddenly on each side to form a spiny process which is much shorter than the stout curved setae; four stout hooked setae inserted at the meson at the caudal end of the cremaster and one inserted on each side on the ventral surface just caudad of the lateral projections of the cremaster.

Length about 12 mm.; greatest width 4 mm.

The larvae of this species were collected on the leaves of gray birch June 26. They are peculiar in that they have no well developed anal prolegs. The last segment bears a cylindrical projection which sticks up and away from the surface of the leaf. The body is roughened and somewhat granular with some wart-like projections on the mesothorax and metathorax and the second abdominal segment. The colors are yellowish or golden brown, with darker brown markings. They spin a thin yellowish cocoon which is usually fastened to the under side of the leaf. Often the leaf is curled over the cocoon so as to conceal it. The pupae are at first a bright yellow brown, but after a day turn dark brown and the bloom appears. The adults emerged July 23.

Genus DREPANA Schrank.

Body of usual shape with two prominent cephalic projections; face-parts not prominently elevated, the labrum being slightly more convex than the remainder; eye-pieces reached only by the prothoracic leg which extends for a short distance between the sculptured eye piece and the antenna; antennae about four-fifths the length of the wings, widest at the proximal

end, where they equal the width of the prothoracic legs; tapering gradually to a pointed tip; maxillae about one-third the length of the wings, the proximo-lateral angles never extending to the eye-pieces; labial palpi entirely concealed; prothoracic legs almost three-fifths the length of the wings, meeting on the meson caudad of the maxillae, for about two-fifths of their length; mesothoracic legs a little shorter than the antennae, meeting on the meson for about the same distance as the prothoracic legs; tips of metathoracic legs exposed between the metathoracic wings; metathoracic wings meeting on the meson caudad of the mesothoracic legs and extending along the mesal margin of the mesothoracic wings to their caudal margin, below which they are visible for the greater part of their length; mesal length of prothorax two-fifths that of the mesothorax; mesothoracic spiracles slit-like; metathorax short, its mesal length only one-third that of the prothorax; abdominal segments 1 to 8 punctate, the punctures thickest along the cephalic margin of the movable segments; abdominal spiracles lenticular in outline, the openings elliptical; cremaster triangular, the distal end widened out and somewhat spherical.

This genus includes but one eastern species *Drepana arcuata* which is found throughout the Atlantic States.

DREPANA ARCUATA Walker.

Fig. 6, E.

Color on head, thorax, and appendages dark brown except the tips of the cephalic projections which are reddish brown, the abdomen dull green mottled with dark brown, the coloring darkest on the dorsum; head, thorax and appendages considerably roughened with indeterminate transverse impressed lines; cephalic projections triangular, their tips slightly curved dorsad, situated on the front adjacent to the proximal ends of the antennae; glazed eye-pieces, clypeus and front smooth and polished; thoracic segments with a slightly carinate median line; abdomen with the first eight segments punctate, the remainder smooth; dorsal furrow between the ninth and tenth segments not distinct forming an indistinct V-shaped depression at the base of the cremaster; cremaster slightly rugose, the basal part triangu-

lar, then a narrow, cylindrical portion which expands into a wider, knob-like end with a row of inconspicuous projections on the dorsal surface.

A pupa of this species was collected from white birch, August 3. The cremaster was entangled in a web of silk on the underside of a leaf, but there was no cocoon present. The adult emerged August 15.

The larvae of these are dark red above and have a pair of prominent tubercles on the first abdominal segment.

LIST OF ABBREVIATIONS.

a.	antennae
a1-a10.	abdominal segments 1-10.
ao.	anal opening.
at.	invaginations for the anterior arms of the tentorium.
cl.	clypeus.
cm.	cephalic margin of an abdominal segment.
cr.	cremaster.
es.	epicranial suture.
f.	front.
f 1.	femur of the prothoracic leg.
ge.	glazed eye-piece.
go.	genital opening.
lb.	labrum.
1_1	prothoracic leg.
2_2	mesothoracic leg.
3_3	metathoracic leg.
lp.	labial palpi.
ms.	mesothorax.
msp.	mesothoracic spiracle.
mt.	metathorax.
mx.	maxillae.
p.	prothorax.
s.	spiracle.
se.	sculptured eye-piece.
sf.	spiracular furrow.
ts.	tubercle scar.
v.	vertex.
w 1.	mesothoracic wing.
w 2.	metathoracic wing.

Fig. 2, A to I.

A Hypothetical pupa, ventral view.
B Hypothetical pupa, dorsal view.
C *Cosymbia lumenaria,* ventral view, female.

D *Sicya macularia,* ventral view, male.
E *Ania limbata,* ventral view, male.
F *Cleora pampinaria,* ventral view, female.
G *Sicya macularia,* dorsal view of tenth segment and cremaster.
H *Ania limbata,* dorsal view of tenth segment and cremaster.
I *Cleora pampinaria,* spiracle and spiracular furrow.

Fig. 3, A to F.

A *Erannis tiliaria,* dorsal view.
B *Erannis tiliaria,* ventral view, male.
C *Paleacrita vernata,* ventral view, female.
D *Paleacrita vernata,* lateral view.
E *Aplodes mimosaria,* ventral view, female.
F *Diastictis ribearia,* ventral view, male.

Fig. 4, A to K.

A *Hydria undulata,* ventral view, male.
B *Sabulodes lorata,* ventral view, female.
C *Cingilia catenaria,* ventral view, female.
D *Hydria undulata,* dorsal view of fifth abdominal segment.
E *Sabulodes lorata,* dorsal view of tenth segment and cremaster.
F *Cingilia catenaria,* dorsal view of tenth segment and cremaster.
G *Diastictis anataria,* dorsal view of cremaster.
H *Diastictis anataria,* ventral view of cremaster.
I *Diastictis ribearia,* dorsal view of cremaster.
J *Diastictis ribearia,* ventral view of cremaster.
K *Sabulodes transversata,* dorsal view of tenth segment and cremaster.

Fig. 5, A to J.

A *Schizura concinna,* ventral view, female.
B *Schizura ipomeae,* dorsal view.
C *Melalopha inclusa,* ventral view, female.
D *Datana angusii,* ventral view, male.
E *Datana angusii,* dorsal view of tenth segment and cremaster.
F *Datana major,* dorsal view of tenth segment and cremaster.
G *Datana integerrima,* dorsal view of tenth segment and cremaster.
H *Datana ministra,* dorsal view of tenth segment and cremaster.
I *Melalopha inclusa,* cremaster.
J *Harpyia borealis,* ventral view, male.

Fig. 6, A to H.

A *Symmerista albifrons,* ventral view, male.
B *Symmerista albifrons,* abdominal spiracle.
C *Heterocampa guttivitta,* ventral view, female.
D *Heterocampa guttivitta,* dorsal view.
E *Drepana arcuata,* ventral view, female.
F *Falcaria bilineata,* dorsal view of tenth segment and cremaster.
G *Apatelodes torrefacta,* ventral view, male.
H *Falcaria bilineata,* ventral view, female.

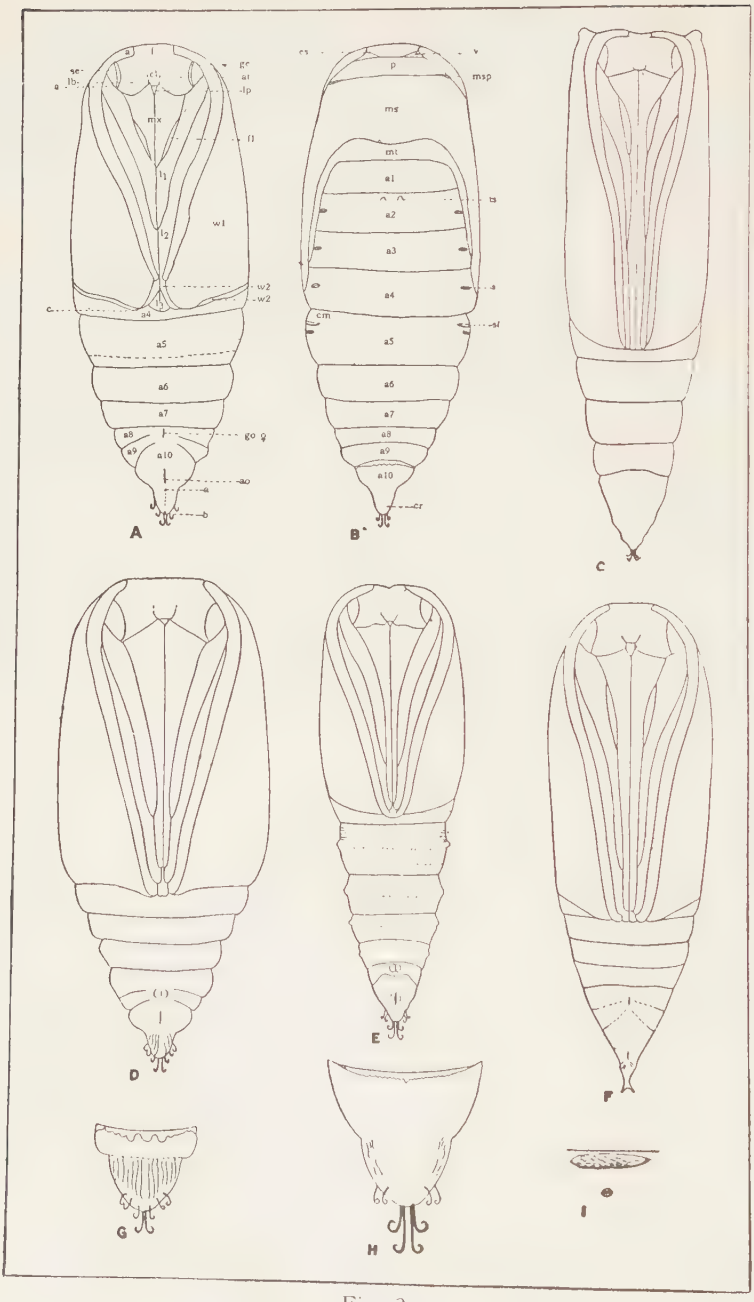

Fig. 2.

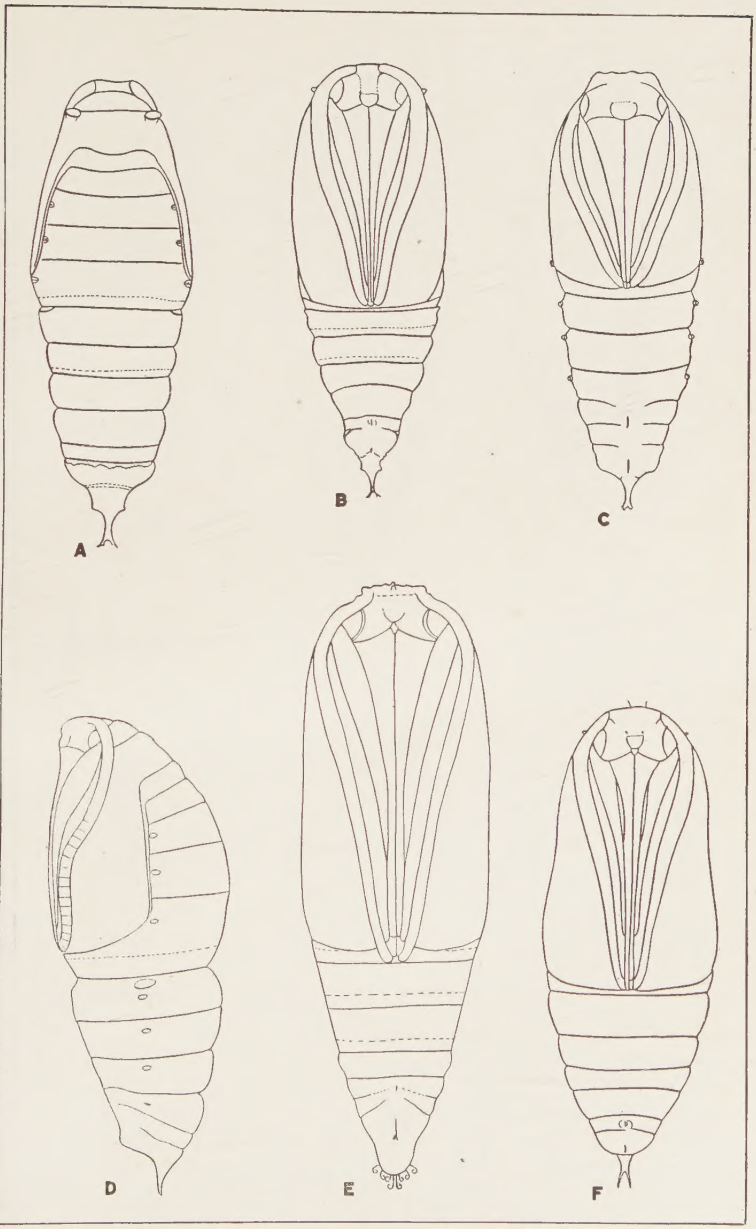

Fig. 3.

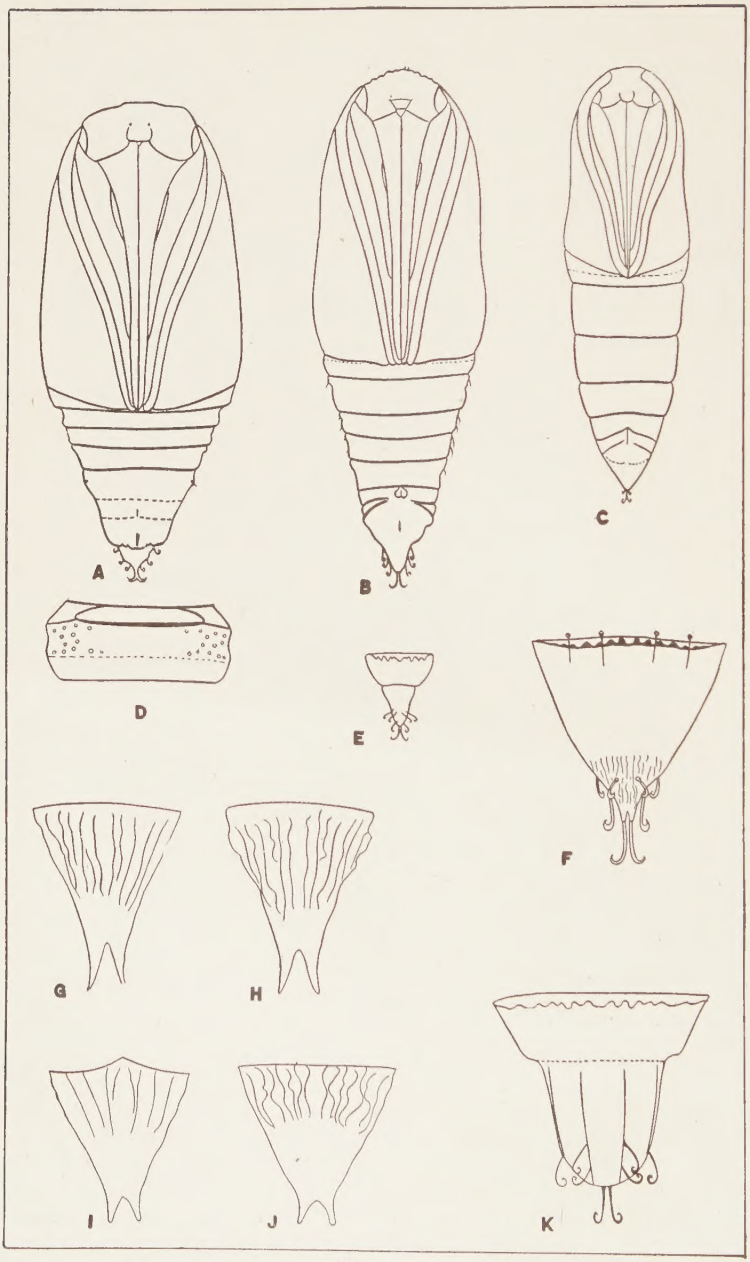

Fig. 4.

I. B. E.

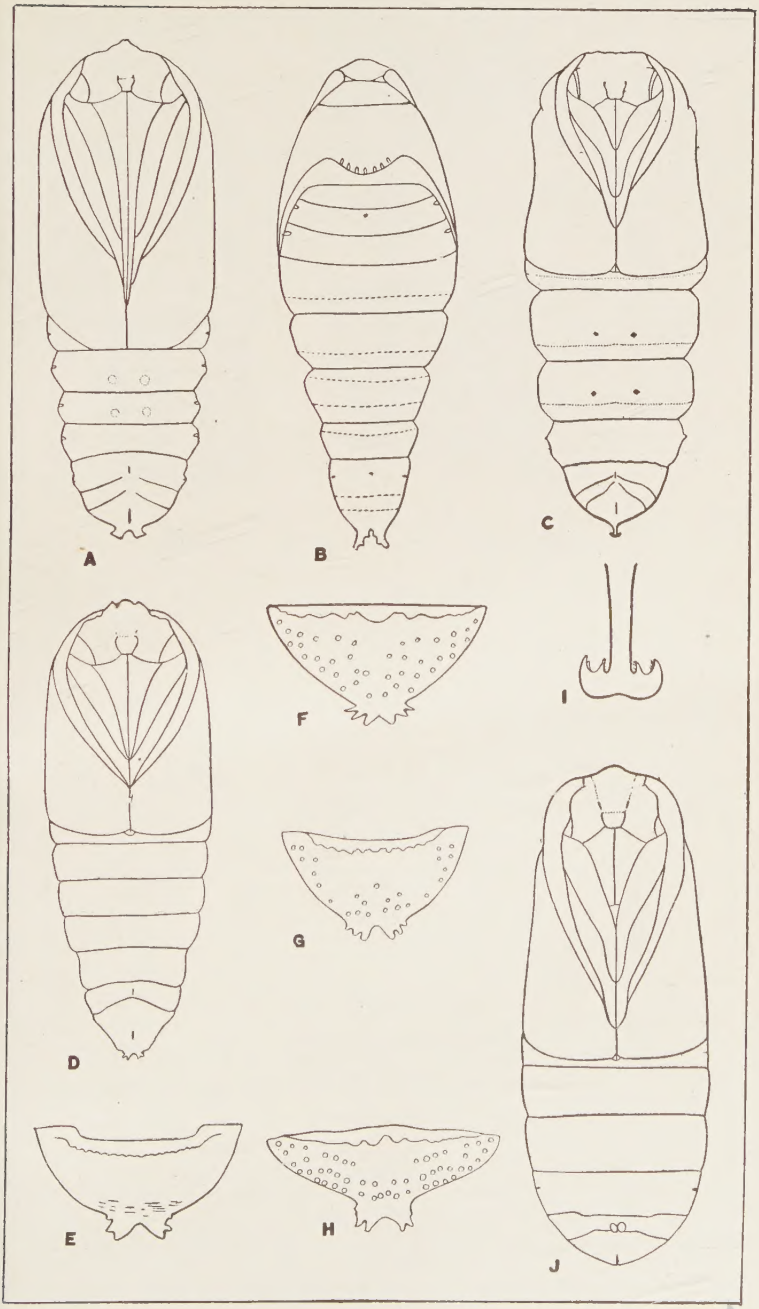

Fig. 5.

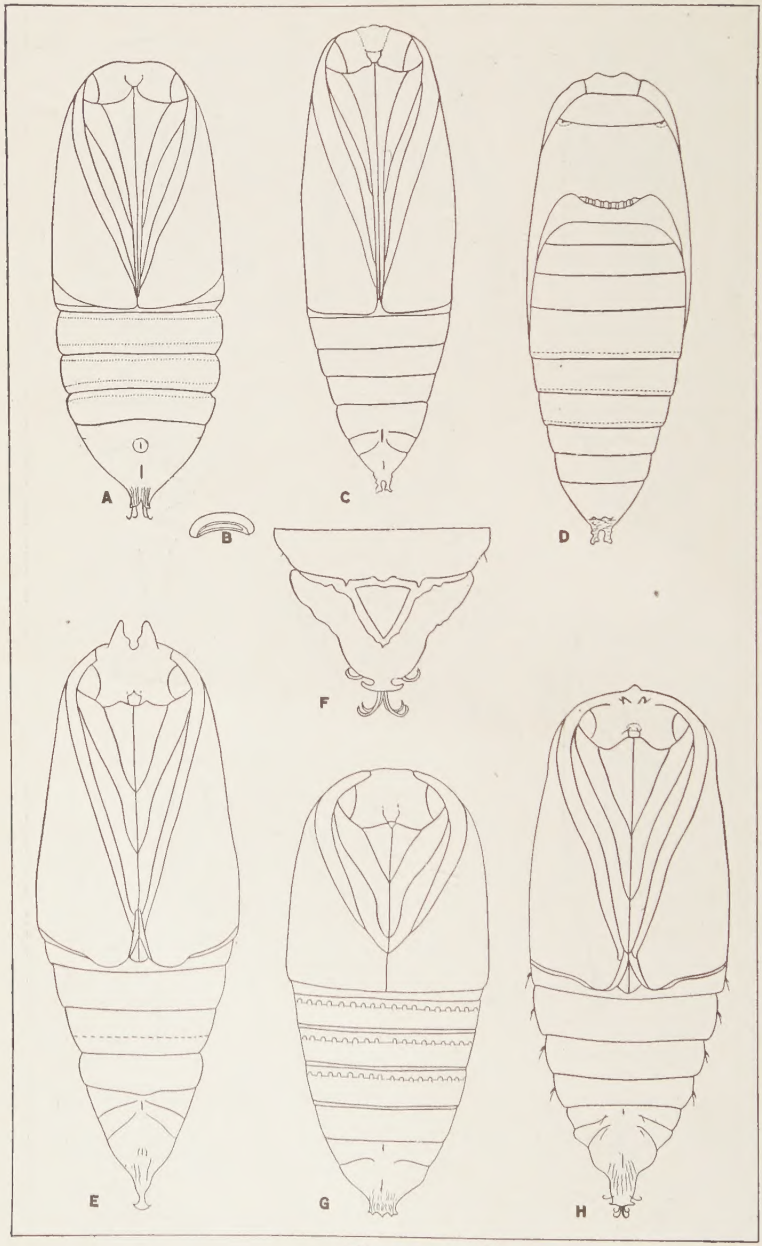

Fig. 6.